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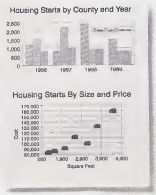

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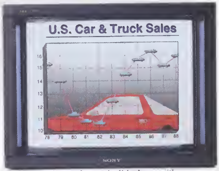

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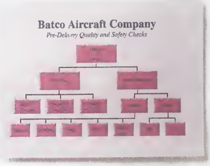

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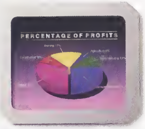

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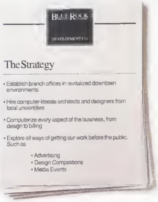
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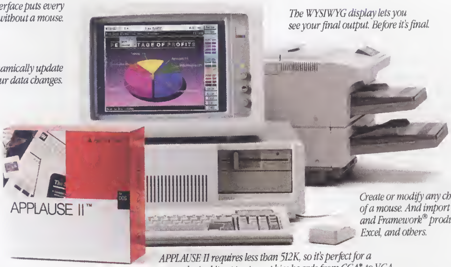

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LOTUS

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STAFF LETTER

A Better Return on Your *LOTUS* Investment

One Saturday evening not long ago, Editorial Director John Campbell was having trouble with a 13-month-old '386-based computer from Northgate Computer Systems of Minneapolis. In desperation, John telephoned the company for help. Amazingly, he got it. For four solid hours, a technical-support specialist guided John while he disassembled and reassembled the computer, troubleshooting the problems. In the early morning hours, the machine started purring like a kitten, and John bid farewell to his telephone adviser.

At 8:30 on Sunday morning, the telephone rang. Another technical-support staffer called to see if the machine was still purring. John reassured the caller that the machine was working, and then he went back to sleep.

While lots of American companies pay only lip service to the concept of improving customer service, several are making good on their claims. We at *LOTUS* firmly believe that customer service is paramount. Our research shows that you, our customer, are interested in the application of microcomputer technology. Hence, our new case study features. This month's story, beginning on page 32, is about how NCR Corp. built a new-product profitability analyzer. NCR's story describes the tension between the information systems department and PC users, less-than-friendly user interfaces, constant trial and error to improve productivity, and incomplete knowledge of alternatives. In short, the real world.

Also in this month's issue, we try again to respond to your needs for more insight and less random information. We realize that you are drowning in a torrent of sometimes meaningless facts and statistics published by other personal-computer magazines as product reviews. To help you make sense of it all, we introduced the Review of Reviews in the June issue. This month Senior Associate Editor Garry Ray, formerly the technical editor at *PC Computing* and a review editor at *PC Week*, cuts through the hype of hundreds of paragraphs of 386SX reviews to provide a concise but comprehensive buyer's guide.

You've also asked for greater access to the people at *LOTUS* magazine and to the information we provide. In response, this issue introduces the "How to Contact Us" box on page 4. If you have a question or want to submit a model or a letter to the editor, you can find our mailing address, MCI Mail and CompuServe account numbers, and our fax number in that section.

The single largest number of requests we get from readers is for an alternative to keying in all the characters in our models. Last year we inaugurated an on-line version of *LOTUS* as part of The World of Lotus forum on CompuServe. You can download the models about a week after the magazine is distributed. Later this year we'll unveil a service for those who want a model but don't have access to CompuServe.

Improving customer service starts by increasing customer communication. Your feedback about each issue of *LOTUS* goes a long way toward shaping future issues, so grade our efforts by filling out the reader-response card between pages 80 and 81. Since you're paying for the magazine, help us give you a better return on your investment.

Larry Marion
Editor-in-Chief

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PRICE IN THE MARKETPLACE

The New Products section [January, page 110] states that the IBM LaserPrinter is "Priced at $2,595, or $100 less than the HP LaserJet Series II...."

While this may be true in terms of list prices, it is not true in terms of the real marketplace. My LaserJet Series II cost $1,695 at a nationally known retailer (not mail order). IBM equipment is sold only through authorized IBM dealers, who seem to be able to control retail prices so that a competitive marketplace does not exist for most IBM products.

Harvey J. Levinsohn
Levinsohn Ten & Co.
New York, N.Y.

The author replies: Mr. Levinsohn's basic point is absolutely right: List price for a product is often wildly different from street price. In fact, discount prices are so common that only the exceptions are remarkable. When I review a product for which the list price is the real price, I mention that fact as being unusual.

But discount prices are as widespread for IBM products as for others, and Mr. Levinsohn is wrong when he implies that IBM products are not widely available at discount.

As with any other product, retail prices of printers depend on such things as volume of sales, wholesale prices, and product availability. I expect the IBM LaserPrinter, as a brand new product, will initially sell for a bit more than the HP LaserJet Series II (or the new LaserJet Series III), which is well entrenched in the marketplace. I also expect the price to drop fairly rapidly, as dealers look for a price that sells the product. If the dealers find that they can charge a premium for the IBM name, and thereby make more profit on each unit, then no doubt they will.

LOAN STATUS REVISITED

"What You Owe: The Loan-Status Analyzer" [November 1989, page 56] is an excellent tool that could be enhanced if it had a data table in which you could enter, say, five different extra-payment amounts, then calculate the total interest paid and the total number of payments required to pay off the loan for each extra-payment amount.

Curtis M. Roberts
Los Altos, Calif.

I've found the loan-status analyzer model very helpful in tracking the principal balance and payoff date for several loans on which additional principal payments have been made. However, the model does not allow you to incorporate more than one dollar amount to be applied in *x* periods. For example, the model does not allow you to pay an extra $100 per month for 10 months and then increase it by $50 for an additional period of time. I suppose you could incorporate the first scenario and then use the principal balance as your new starting value. Can you modify the model to address this?

Anthony C. McGill
Deloitte & Touche
Chicago, Ill.

Editor's note: Assign the names *extra2*, *start2*, and *end2* to cells F10, F11, and F12, respectively. Assign the General format to range F11..F12. Enter the second extra-payment amount in cell F10, the starting period of the second extra payment in cell F11, and the ending period of the second extra payment in cell F12.

Replace the second *Extra Principal* formula in cell E19 with:

```
IF($START<=A19#AND#$END>=A19,
  @MIN($EXTRA,F18–D19),@IF
  ($START2<=A19#AND#$END2>=A19,
  @MIN($EXTRA2,F18–D19),0))
```

Finally, copy this new formula down the entire column of *Extra Principal* formulas.

HOW TO CONTACT US

We like to hear from you—whether you have a suggestion, a submission, a query, a complaint, or even a compliment.

You can phone us at 617-494-1192. But we suggest that you write to us instead—via regular mail, fax, or MCI Mail. That makes it easier for us to get your communication to the right person(s).

Mail P.O. 9123, Cambridge, MA 02139-9123
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MCI Mail General (Larry Marion)—412-6887
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You can also address *LOTUS* magazine in the LDC Spreadsheets Forum on the CompuServe Information Service. See Electronic Retrieval, below.

SUBMISSIONS

Models. To share a model with *LOTUS* readers, send it to the Models Editor. Explain what problem the model solves, how the model differs from other solutions, and what lessons it teaches. Include your credentials and a floppy disk.

Articles. If you wish to write tutorials, product reviews, case studies, or other material for *LOTUS*, write or send E-mail to Larry Marion, Editor-in-Chief. Include your credentials and samples of your work.

Letters. We welcome letters for publication. If you want your letter considered for publication, send it to Eleanor McCarthy, Managing Editor. If your letter concerns one of our macro-oriented columns, send or E-mail it to Nicholas Delonas, Macros Editor.

Q&A and Good Ideas. Send submissions to Carrie Thomas, Technical Editor.

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Models published in *LOTUS* since 1988 are available in the *LOTUS* library, part of the LDC Spreadsheets Forum (GO LOTUSMAG) on CompuServe. For more information about *LOTUS* on line, call CompuServe, 1-800-848-8199, and ask for representative 146; if outside the U.S. and Canada, call 1-614-457-0802. For information on how to download *LOTUS* models from CompuServe, see page 80 of the January 1990 issue. The models are also on Lotus CD/Prompt.

Abstracts of selected *LOTUS* articles can be found through Dialog Information Services (Palo Alto, Calif.) in Microcomputer Index (Learned Information Inc.) and in Business Software Database (Information Sources Inc.).

ADVERTISING

LOTUS accepts advertising only from vendors it considers responsible. If you have a problem with an advertised product that you cannot resolve with the vendor, write to Mark D. Flanagan, Publisher.

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ABOUT THIS MAGAZINE

LOTUS is published monthly by Lotus Publishing Corp., a subsidiary of Lotus Development Corp., and is intended to help users of Lotus spreadsheet software. The editorial content of *LOTUS* is not determined by Lotus Development Corp., and the software reviews and other opinions expressed in *LOTUS* do not necessarily represent the views of the parent corporation.

PAY YOUR MONEY, TAKE YOUR CHANCES

I decided to use the stock-market-timing spreadsheet "When To Get In, When To Get Out" [October 1989, page 32] to follow a mutual fund that I was planning to buy. I did two spreadsheets, one with a 10-week moving average and one with a 10-day moving average. The 10-week moving average did not give any indication to sell before Oct. 13, 1989. The 10-day moving average did give an indication to sell but not until the market close on Oct. 12.

The fund I was following does not process a buy or sell until the market closes. So, if I had used the indication of the 10-day moving average, the fund would not have been sold until the market closed on Oct. 13, with disastrous results. If I had modified the formulas in column G so that they continued to give *BUY/HOLD* signals only if moving averages for the fund and the Dow were *both* below the most recent amount, the indication to sell would have been given on Oct. 11. The value for the Dow fell below the 10-day moving average on Oct. 11. With the market, you pay your money and take your chances.

Howard Last
Great Neck, N.Y.

The author replies: On Oct. 12 the Dow Jones closed at 2759.84. The 10-day moving average on that day was 2760.1. In other words, the price for that day was below the moving average, but only by a fraction of a point. On Oct. 13 the Dow fell 190 points. As Mr. Last points out, selling a fund on the 13th, based on the Dow going below the moving average on the 12th, would have been too late. He also points out, correctly, that using a 10-week moving average would not have triggered a sell signal before the 13th.

However, using a weekly moving average for a longer number of weeks (I generally use a 39-week moving average) would not have triggered any sell signals in October. This seems to be a problem until you realize that the Dow recovered from the Oct. 13 drop. As it turned out, those who held onto their funds through October's temporary setback are better off.

Regarding the formulas in column G: The formula, as printed in *LOTUS*, already requires both moving averages to be less than the most recent amount to trigger a new *BUY/HOLD* signal. You could modify the formula to trigger a new *WAIT/SELL* signal when either moving average happened to rise above the most recent amount, but this would result in more-frequent selling and buying of an investment.

Finally, it is always true that you take your chances with investing, and it is no less true for users of this model. It's good that you tried the model first, without investing any money.

Letters to the editor should be sent to Eleanor McCarthy, Managing Editor, *LOTUS* Magazine, P.O Box 9123, Cambridge, MA 02139-9123. Please include a daytime phone number. Letters may be edited for length and clarity.

The Compiler for Lotus 1-2-3 v2.2

King Jaguar 2.2 supports **all** Lotus 1-2-3® (1.0A, 2.01, 2.2) macros and fomulas. In addition, the following features make the new King Jaguar the obvious choice when choosing a compiler:

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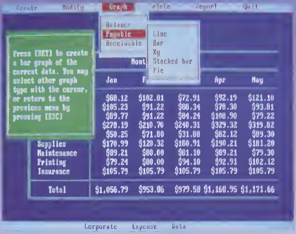

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CIRCLE 102 ON READER SERVICE CARD

Lower Prices Fuel Sales of 8-Megabyte Boards

OS/2, *Windows*, and beefier applications need as much memory as they can get.

Since memory prices took a nosedive in late 1989, buyers have been gobbling up 8-megabyte add-on memory boards. The 8-megabyte boards have been around for about two years, but "until prices dropped, users hesitated to invest in extra memory," says Paul Zagaeski, a senior analyst with The Yankee Group, a Boston market research firm. "Now, with OS/2 and some of the newer, high-powered software, people need more than 2 megabytes of RAM."

Estimates of the market for 8-megabyte boards are unavailable. What is known, however, is that people are paying a lot less for extra memory. A year ago, for example, the popular Rampage Plus 286 board from AST Research sold for $1,445 with 2 megabytes of memory. Now, the board lists for $995, and the street price is at least a couple of hundred dollars lower. Other manufacturers' prices have been shrinking since the beginning of last summer, when 1-megabit chips became more readily available. "It's not just boards going down in price," says Len Herbstman, senior product-marketing manager at AST. You can plug a 2-megabyte upgrade into your board for about $140.

About 10 manufacturers, including AST Research (Irvine, Calif.), Cumulus Corp. (Cleveland), and Intel Corp. (Hillsboro, Oreg.), sell 8-megabyte boards, and more are likely to follow. Most 8-megabyte boards cost $300 to $600 with no memory installed. An 8-megabyte board with 2 megabytes installed costs $900 to $1,000. A board with a full 8 megabytes on it costs about $2,100, but you can do even better if you buy the chips and install them yourself.

Lower price is what finally prompted Margot Holtzman, office manager for Chatham Venture Corp. in Lexington, Mass., to buy an 8-megabyte board. Holtzman had 2 megabytes on her motherboard but wanted more memory so that she could run *1-2-3* and other applications under *Desqview*, Quarterdeck Office Systems' multitasking environment. "I was tired of having to load and unload programs," she says. "But I wouldn't have made the move if the price hadn't come down."

Holtzman is not alone in her interest in more memory. Many DOS users want to run their programs in multitasking environments, such as *Desqview* and *Microsoft Windows*. Just as many need more memory for large applications, such as *1-2-3* Release 3, *Microsoft Word for Windows*, *WordPerfect*, Samna Corp.'s *Ami Professional*, Xerox Corp.'s *Ventura Publisher*, Borland International's *Paradox*, and Symantec Corp.'s *Q&A*.

'RIGHT NOW, PEOPLE NEED AN EXTRA MEGABYTE JUST FOR BIG SPREADSHEETS.'

And for those who make the switch to a beefier operating system, such as OS/2 or Unix, extra memory is a must. OS/2 currently needs about 4 megabytes to be useful, although Microsoft says it intends to reduce the memory requirement in the next version, expected to be released this year. To run an application or two, you need 6 or 7 megabytes, estimates David Cearly, a program director with the Gartner Group, a market research firm in Stamford, Conn. "And if you go to IBM's OfficeVision or to IBM's OS/2 Extended Edition 2.0," he adds, "you may need as much as 10 or 12 megabytes."

Robert Kinsella, senior systems analyst for the New York Power Authority, in Marcy, N.Y., says that "right now, people need an extra megabyte just for big spreadsheets." But the 8-megabyte boards Kinsella bought for the company have less than 8 megabytes installed. "If we move to OS/2, everyone will need much more," he explains. "I like knowing I can go up to 8 megs if I have to."

Eight megabytes is the maximum amount of memory manufacturers can fit onto a typical board using 1-megabit chips. For more than 8 megabytes, manufacturers have to use 4-megabit chips or, more likely, attach piggyback cards. Intel's Above Board Plus 8, for example, can take a 6-megabyte piggyback card, for a total of 14 megabytes.

Board manufacturers are helping to drive the trend toward higher-capacity boards by phasing out their smaller boards. AST Research, for example, sells only one board with a capacity lower than 8 megabytes: the SixPak 286, which has a 4-megabyte maximum. Intel offers only the 2-megabyte Above Board Plus in its under-8-meg lineup for PCs and PS/2s. And none of Cumulus Corp.'s boards has a capacity lower than 8 megabytes.

Nonetheless, most people, like Kinsella, buy the 8-megabyte boards with less than 8 megabytes of memory. "Until last October, virtually nobody bought fully configured memory boards," says Marty Alpert, Cumulus's chairman and CEO. "Even now, only about 20% of our buyers go for 8 megabytes right off the bat." Unless they've moved to OS/2, business users generally don't need more than 4 megabytes of RAM. Since many new systems—particularly 80386 machines—go out the door with 2 megabytes, a 2-megabyte add-on board is more than adequate to start with.

Like most newer add-on memory

ORIGINAL SALT WATER TAFFY CUT TO FIT THE MOUTH
ORIGINAL SALT WATER TAFFY CUT TO FIT THE MOUTH
Amy L. Wasserman

AMY L. WASSERMAN

boards, 8-megabyte boards can be configured for any combination of expanded and extended memory. You can split up the RAM any way you want and change it whenever you like, but you should know what kind of memory you need.

For most DOS programs, you need expanded memory, that is, memory above 1 megabyte that conforms either to the Extended Expanded Memory Specification (EEMS) or to the Lotus/Intel/Microsoft Expanded Memory Specification (LIM-EMS). DOS can use expanded memory as if it were part of conventional memory–the memory between 0K and 640K, which is where DOS applications are designed to run. Expanded memory is slower than extended memory because data or program code stored in expanded memory must be transferred to conventional memory before it can be used. The expanded memory manager must constantly shuttle data and program code between the expanded memory space and a small space in conventional memory.

Few DOS programs can use extended memory, which is available only on '286 and '386 machines. To use extended memory, a DOS application must be written to operate in the '286's and '386's "protected" mode–so called because it protects programs running concurrently from overwriting one another or colliding.

Some DOS applications, however, including *1-2-3* Release 3, incorporate DOS-extender technology, which allows DOS to use extended memory. Other than DOS-extended programs, only OS/2 and applications written for it can freely use extended memory. Current versions of OS/2 don't support expanded memory, so DOS applications running in the compatibility box can access only 640K of random-access memory.

The 8-megabyte boards can all be configured for expanded or extended memory, but they are not all alike. Boards intended for 80286 computers or lower generally have built-in LIM-EMS or EEMS, or both. For most 80386 machines, the specification is software-based. This is a more flexible arrangement: Instead of replacing the board in the event of a specification upgrade, especially an upgrade as radical as that from LIM-EMS 3.2 to 4.0, you can just install a software driver.

Boards also differ in performance. For example, some memory boards are slower than the computer's CPU, which means that the CPU is periodically idle–in a wait state–while the memory catches up. Before buying a board, check its spec sheet for wait states.

Other factors that affect performance are how efficiently a board uses memory above 640K and how specifically it can address the memory between 640K and 1,024K, which is generally reserved for graphics, network, and other special drivers. For best performance, look for a "yes" answer to the following two questions:

1. Can the board map more than 64K above 640K?

2. Can the board use memory in noncontiguous areas?

The spec sheet can help you find the answers. If a board supports EEMS or both EEMS and LIM-EMS, the answer to both questions is "yes." If a board supports LIM-EMS version 4.0 only, the answers are "yes" or "no"; you have to ask the manufacturer. If the board supports only an earlier version of LIM-EMS, the answer to both questions is generally "no."

A better way to find the answers is to use *QTest*, a utility from Quarterdeck Office Systems. *QTest* evaluates a board and describes its capabilities in both technical language and plain English, according to Gary Saxer, Quarterdeck's director of technical services. Quarterdeck distributes the program free to dealers and user groups, at trade shows, and on bulletin boards.

—Henry Fersko-Weiss

HOW TO BE IN TWO PLACES AT ONCE

Remote-control software earns points with business users.

AMY L. WASSERMAN

Mention remote control and you probably think of the hand-held channel changer that keeps television viewers anchored to their sofas. But to a growing number of businesspeople, remote control also describes a special class of communications software that, essentially, lets them be in two places at once.

With remote-control software and a modem, you can use your personal computer to operate a second PC residing a few floors or a few states away, whether or not there's someone at the other end. You can issue operating system commands, run applications, exchange messages, and send files between the two machines. And you can do it as easily as if the remote PC were sitting in front of you.

Remote software is not new. The first of these products appeared in the early 1980s, and there is now a small cadre of well-established names in the MS-DOS field. The programs include *Carbon Copy Plus* from Microcom Software Division in Danbury, Conn. ($199 each for host and remote programs), *pcAnywhere III* from Dynamic Microprocessor Associates in New York ($145 for a host-remote combination), *Close-Up* from Norton-Lambert Corp. in Santa Barbara, Calif. ($195 for host program; $245 for remote), *Remote2* from DCA/Crosstalk Communications in Roswell, Ga. ($195 for host-remote combination), and *Co/Session* from Triton Technologies, Iselin, N.J. ($249 for host-remote combination).

Into the mainstream. What is new is the increased interest that businesspeople are showing in a product that has been used mostly as a long-distance technical-support tool for hardware and software sellers. While the market is still too small for most research firms to track, Mark Leary, an analyst with International Data Corp., a research firm in Framingham, Mass., estimates the accumulated sales of remote-control software to be between 500,000 and a million copies.

"There's been a definite shift toward more mainstream business use," claims Richard de Mornay, Norton-Lambert's vice president of marketing. "Technical people were the first to discover remote-control software," he says, "but now businesspeople are discovering it."

One reason, say analysts, is the need for better in-house technical support. With the number of PC users on the rise and their geographical distribution expanding, information-center and work-group managers are adopting remote-control software as a way to keep the technical wheels greased. Using remote-control communications, support people can diagnose and fix a problem on a machine a thousand miles away or walk a distant colleague through an application. For example, a *1-2-3* user in the San Francisco office who is having trouble with a complex macro can call a *1-2-3* expert in the Boston office and demonstrate the problem screen to screen, if not face to face.

The upsurge in home-office and after-hours computing is also a catalyst for remote-control software. Rather than ferry floppies between home and office, remote-control software lets you run programs and transfer your worksheets and other files from either computer. And while it might seem complicated, establishing a remote connection isn't hard to do. Since the remote software knows what it will find at the other end, there are no start bits or stop bits and no parity or protocol settings to deal with as there are with general-purpose communications programs.

Many in the burgeoning ranks of laptop toters are embracing remote software, too. Space constraints are a major reason. Programs or databases that would be difficult or impossible to squeeze into the limited storage of a laptop, for example, can be accessed by modem instead. Remote control also lets traveling businesspeople enter orders, check inventory, and initiate other transactions on the road. "More people are using laptops, and we're seeing a consequent rise in remote computing," says Chuck Rudolph, vice president and general manager of DCA/Crosstalk Communications. "It's one of the largest growth areas for remote software right now."

Long-distance LAN hookup. Ironically, local area networks are another force behind the boom in long-distance computing. Most remote packages let you tap into the applications and shared resources of a LAN by connecting, remotely, to one of the PCs on the network. That frees people from the physical limitations of a LAN and can cut costs if several users remotely share one PC on the network. "People want access to all the applications and services of a LAN without being tied into one," explains Matt Olenski, Microcom Software's product manager for *Carbon Copy Plus*. "Remote control gives them that."

Indeed, in a recent survey, Novell (Provo, Utah), a leading vendor of network operating system software, found that 35% of its customer base–which totals about 4 million people tied to 400,000 servers–need remote-access solutions for their LANs. The company has responded by incorporating technology from Dynamic Microprocessor Associates' *pcAnywhere* into products it calls *NetWare AnyWare* and *NetWare Access Server*. The programs enable single and multiple users, respectively, to tap into Novell NetWare LANs. Demand for the products has been very strong, says Steve Goodman, product manager for remote-access products at Novell. "It's a market that really hasn't been tapped yet," he says.

> REMOTE CONTROL
> LETS YOU USE
> THE SERVICES OF A
> LAN WITHOUT
> BEING TIED INTO ONE.

If there's a serious impediment to meeting the rising demand for remote computing, it's speed. The 1,200-bps and 2,400-bps modems used for most PC telecommunications work fine for shuttling text over the phone lines. But transferring graphics at those speeds can be excruciatingly slow, and graphics-based applications may soon become the norm with the onset of OS/2's Presentation Manager and other graphical user interfaces.

Faster 9,600-bps modems and ISDN phone lines with high bandwidths may provide the hardware solutions, but remote software will have to get better at compressing information, too. Says David Saphier, president of Triton Technologies: "We're working on it."

—*Christopher O'Malley*

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PHOTO BY ED KASHI

More than 500 publishers have used some version of the budgeting-and-forecasting model that John Klingel helped create.

JOHN KLINGEL: RUNNING A MAGAZINE ON 1-2-3

The most widely used PC publishing model

Recently, magazine publisher John Klingel had a king-size spreadsheet headache that literally flashed before his eyes. Just calling up the menu macro on the *1-2-3* model he used to run his magazine activated the blinking out-of-memory light on his computer screen. It meant he was almost out of conventional memory (640K or less) on his 20-MHz Compaq Deskpro 386 equipped with 4 megabytes of RAM.

Part of Klingel's problem was the sheer size of his model–some 77,000 cells eating up 3 megabytes of hard-disk space. He knew that adding more memory chips wouldn't help because it was *conventional* memory his Release 2.2 model craved, not expanded or extended memory. He decided to solve his problem by making his model bigger.

As a circulation and magazine startup consultant, Klingel pioneered the use of PCs in the publishing industry nearly a decade ago as a cost-effective way to make circulation projections and manage the financial side of the business. Back then he helped Natick, Mass.–based Lighthouse Business Systems create a *1-2-3* model to run on the new IBM PC.

Since then, more than 500 periodical publishers around the world–including *LOTUS* magazine–have used some version of it for budgeting and forecasting. "In terms of sheer numbers, Lighthouse is the most widely used circulation model in the business," says Gary Smith of Neodata Services, a leading subscription-fulfillment house and a unit of Dun & Bradstreet.

Now, Klingel is the publishing director for the Sausalito, Calif.–based *In Health* (formerly *Hippocrates*), one of the hot new consumer health magazines. At *In Health*, which is 50% owned by Time Warner Inc., Klingel is pushing his model to new extremes. It now contains 250,000 cells and occupies 18 megabytes of disk space, making it six times larger than the old model.

Magazine publishing is mainly a cash flow business characterized by complicated relationships among circulation, revenues, and costs. For example, a decision to send out more direct mail pieces to increase circulation triggers a series of events that ripple through the entire operating statement. Higher direct mail costs generate more subscription and possibly advertising revenue but also increase printing and postage bills.

Klingel's modeling at *In Health* has expanded from a single magazine, which has grown to a circulation of 600,000 in three years, to an additional newsletter with a circulation of 100,000 and a new 200,000-circulation trade magazine for physicians. A second newsletter is in the works. Each has a separate model with a six-year cash flow plan. "Our revenue sources have gotten incredibly complex," says Klingel. "There's an awful lot of detail we have to include in the model."

Klingel does six-year projections twice a year, but he and his circulation director do "quickie" one-year projections almost weekly. "We're constantly evaluating our future strategy," he says.

As the old model continued to grow, so did memory and speed problems. Recalculation time in Release 2.01 rose to more than seven minutes on a PC with an 80286 processor. The speedier 80386 cut the time to less than two minutes, but Release 2.2 didn't solve the memory constraints. Release 3 opened up memory, but Klingel got a nasty surprise when he found that it tripled recalculation time to more than seven minutes. Still, he didn't want to abandon Release 3 because he found it to be superior to Release 2.2 in performing several tasks.

That's when he called in Lighthouse spreadsheet designer and consultant Tom Low to perform corrective surgery on the *In Health* model. They decided that by breaking the spreadsheet into modules, they could make room to add the detail Klingel wanted on cash flow timing. The five modules that resulted project the number of copies printed for each issue, circulation income and expense, production costs, and salaries and overhead. For the less-frequent, longer-range what-if projections, the modules have been set up to feed data to the circulation-expense module, which acts as a window into the rest of the model.

The data that is needed from other modules is brought in through Release 2.2's new "link" function, which eliminates the need for a complicated, memory-hungry macro to consolidate this data.

It works this way: Each module contains a holding area for summaries of the calculated data within each module that needs to be reintegrated into the main module. When the main module is loaded, certain linking formulas in it automatically retrieve the summary data directly from the other files on the hard disk.

Anyone who's worked with large models knows they possess two inherent weaknesses: They have steep learning curves and they are error prone. "This model is extremely hard to learn," says Klingel. "Most people who are good at it learned how to do magazine analysis manually on green ledger sheets."

Low agrees that such a background is almost a necessity to understand the logic of spreadsheets as complex as this one. When he trains people, Low says he often prints out the entire model and then pieces together the elements to show how the logic flows.

Printouts are also a good way to find errors. "I can see patterns and blips and find errors on a printout that I can't see when I'm looking at six columns on a screen," Low says.

Error-checking utilities are available to test formulas for errors, but Low says they don't work well on a model like this because the formulas vary too much from month to month. He prefers to run his own benchmark tests. In the subscription section, for example, he cancels out each of 17 different subscription sources, then inputs the same numbers again and checks for identical output each time through.

Grouping is a design technique to help reduce inputting errors. In the previous example, each of the 17 subscription sources required separate entries to record corresponding promotion and processing costs for each subscription. In the revised module, Low clustered all of these inputs into a common block to lessen the likelihood of a missed entry.

The ultimate tool in rooting out errors, however, is an experienced human eye that can "see things that don't look right," says Low. "I know that sounds vague and imperfect for programming, but I still think that's the best way."

Is a spreadsheet model this big too big? Low confesses that traditional programmers tend to "wrinkle their noses" at his monster models. "They say a spreadsheet shouldn't be larger than a few hundred kilobytes," he says. Anything larger should be done outside a spreadsheet environment. Mainframe publishing models, the alternative to PC spreadsheets, cost three to four times as much as a PC model and aren't nearly as flexible. As for PC database models, Low knows of one *dBase* programmer who tried and failed. "There were too many variables," he says.

Ironically, each of the new modules is nearly as big as the old model was. The new ones run faster because their formulas are more efficient, but the increased bulk means there is no room for add-ins other than *SQZ*, which cuts disk-storage requirements by half. Low had to disable two of Release 2.2's built-in features—Undo and the *Allways* print-formatting add-in—because they wouldn't fit.

In any case, John Klingel isn't about to abandon his spreadsheets. "There isn't anything we want that *1-2-3* can't do," he concludes. "It's just a question of which version to use and how to make it work most effectively for our needs."

—A. Richard Immel

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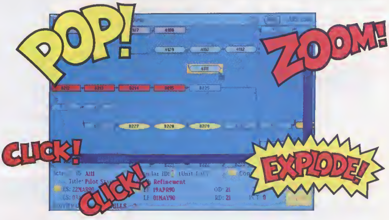

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TONY SCARPETTA

On keyboard: Dr. Oliver Strimpel, director of Boston's Computer Museum and parent of the Walk-Through Computer project.

Back to ENIAC

When it comes to computers, small is beautiful. That is, unless you're a visitor to Boston's Computer Museum, the world's only museum dedicated to computers. The museum has just unwrapped an exhibit called the Walk-Through Computer, a two-story working model of a desktop computer. The $1.2 million project is the largest ever undertaken by the museum, which opened in 1984 and occupies a nineteenth-century warehouse overlooking Boston Harbor. More than 25 companies–including Apple Computer, Digital Equipment Corp., Intel Corp., and Lotus Development Corp.–contributed to the project.

At up to 50 times actual size, the Walk-Through Computer is only slightly larger than the earliest computers. ENIAC, for example, developed in the mid-1940s at the University of Pennsylvania, consisted of forty 9-by-2-by-1-foot panels. The Walk-Through Computer boasts a 108-square-foot monitor, a 25-foot working keyboard, a 6-foot floppy disk, and a 9-by-6-foot trackball. The exhibit's designers opted for a trackball instead of a mouse because they feared a mouse might mow down small children as visitors pushed it across its giant pad.

The computer runs a software program called *World Traveler*. Visitors can use the overgrown trackball and keyboard to select among 300 cities in eight regions of the world. The program not only finds the shortest driving route between any two cities in a region but displays a slide show of sights along the way.

Inside the exhibit, visitors can see the computer's operations, from the immense hard-disk platter spinning as it retrieves information to flashing banks of memory chips. "We want people to see that computers are complex but to feel that they could understand them if they had the time," says Dr. Oliver Strimpel, the museum's executive director.

—Jennifer Smith

Spreadsheet Sales to Double by 1993

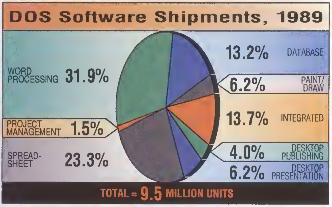
Next to word-processing programs, spreadsheets constituted the second most popular DOS business application last year, according to International Data Corp., a market research firm in Framingham, Mass. Spreadsheets accounted for more than 2.2 million of the 9.5 million DOS-based business applications shipped in 1989. And with a market share of close to 70%, Lotus claimed about 1.5 million of those.

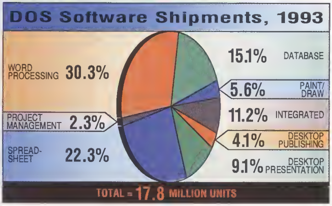
Spreadsheets will retain their relative position through 1993, predicts IDC, but the number of packages shipped will nearly double. Of about 18 million packages projected, word-processing programs will account for approximately 5.4 million and spreadsheets for almost 4 million.

IDC forecasts the most dramatic growth for presentation-graphics and project-management applications. The former category, which includes such programs as *Harvard Graphics* and *Lotus Freelance Plus*, is expected to increase 175%, from 589,000 packages in 1989 to 1.6 million in 1993. IDC expects the project-management category to grow 187%, from 142,500 to about 410,000.

However, it's still too early to predict the popularity of DOS packages. The effects of OS/2 could change the outlook for certain applications, concedes IDC analyst Joan-Carol Brigham. "A lot of things could happen between now and 1993," she adds. "Someone could come out with a killer application, or Apple could decide to allow Mac clones."

—J. S.





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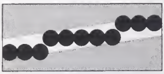
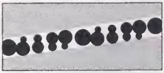


In ordinary laser printers, stair-steps of dots leave jagged diagonals and curves.



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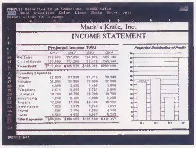

In 1-2-3 Release 2.2, spreadsheet publishing means what-you-see-is-what-you-get.

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Lotus 1-2-3 Release 2.2
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Lotus Announces 1-2-3 for Windows

Development is underway for a version of *1-2-3* for *Microsoft Windows* 3.0, the recently released upgrade to Microsoft Corp.'s DOS-based graphical operating environment. (For an in-depth look at *Windows* 3.0, see page 88.) Frank Ingari, vice president of Lotus's personal-computer spreadsheet division, announced *1-2-3* for *Windows* 3.0 at a recent press conference but declined to comment on the price or availability of the product.

Ingari noted that the *Windows* version of *1-2-3* will have the look and feel of *1-2-3/G* but said Lotus hadn't decided whether to include Solver and Backsolver, *1-2-3/G*'s goal-seeking features.

1-2-3 Release 3.1 (see last month's @Lotus column) should go a long way toward providing the graphical features users want. But Lotus has made a commitment "to deliver our spreadsheets on any computing platform that is important to our users," Ingari said. And *Windows*, Lotus has concluded, is important to Lotus users. Performance and memory problems in earlier versions of *Windows* kept Lotus from developing a *Windows* version of *1-2-3*, said Ingari, but improvements in *Windows* 3.0 have changed the picture.

Nonetheless, Lotus continues to recommend OS/2 with Presentation Manager as the graphical personal computer operating system of choice. "We still believe OS/2 provides the most reliable base for multivendor systems and the most economical growth path," Ingari said. "At this point," he quipped, "*Windows* is 5% of the market and 80% of the noise."

BRIAN LIES

Lotus-Novell Merger Off

Lotus and Novell called off the proposed merger they announced in early April. Discussions broke down over Novell's "sudden and unexpected" demand for an eight-member board of directors, says Jim Manzi, Lotus's president and CEO. The original agreement called for four members from Lotus and three from Novell. Novell confirmed that it was unwilling to go forward without equal board representation, which it said was crucial to the combined company's success. Lotus said it thought a four-four board was a prescription for deadlock.

The derailment of the merger does not change Lotus's strategy, says Manzi. Neither, he adds, will it affect the joint customer-support program that Lotus has established with Novell and other network vendors. "We plan to continue delivering quality products to our customers, providing the applications they need on the platforms they choose, along with the support they require."

Lotus Acquires AlphaWorks

Lotus Development Corp. has acquired *AlphaWorks*, an integrated software package for entry-level PC users, from Alpha Software Corp. of Burlington, Mass. *AlphaWorks* 2.0, renamed *LotusWorks*, provides spreadsheet, database, graphics, and communications capabilities, as well as a word processor with a spell checker, a thesaurus, and mail-merge functions. Alpha Software claims to have shipped more than 300,000 copies of the program since its introduction in 1983.

LotusWorks is targeted at small businesses, home offices, and educational organizations. Lotus will continue to sell *Symphony*, which has an installed base of more than a million, to large organizations and to customers who want a more sophisticated integrated package.

LotusWorks supports industry-standard file formats, including *1-2-3*'s WK1 and *dBase*'s DBF formats. The program will be available from Lotus for a suggested retail price of $149. Users of *AlphaWorks* 1.0 or its predecessor, *Electric Desk* 1.0, may upgrade to *LotusWorks* for $49. For further upgrade information, call 800-343-5414.

Several computer makers, including Olivetti Office USA, Poqet Computer Corp., and Packard Bell, will include *LotusWorks* with their products. Olivetti will bundle *LotusWorks* with all the 80286 and 80386SX systems it sells in 1990. Poqet Computer will make *LotusWorks* available on a ROM card for The Poqet PC. A ROM-card version of *Lotus Agenda* 1.0 is already available for The Poqet PC; Poqet Computer expects to release a ROM-card version of *1-2-3* Release 2.2 in July.

Until July 18 Lotus and Alpha Software will provide joint telephone support for *LotusWorks*; thereafter, Lotus will assume the entire support function for *AlphaWorks* 2.0 and *LotusWorks*.

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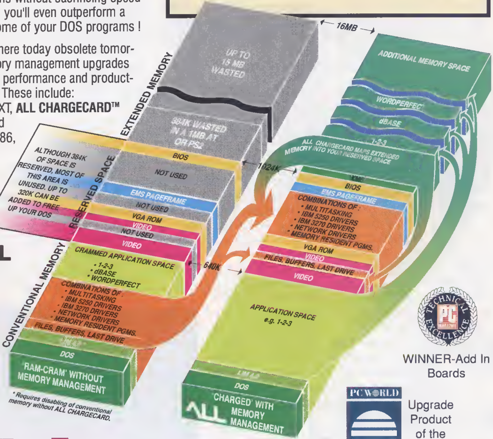

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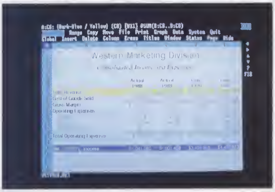
More on 1-2-3 Release 3.1


A:C6: {Dark-Blue / Yellow} (C0) [W11] @SUM(B:C8..B:C8)
Range Copy Move File Print Graph Data System Quit
Global Insert Delete Column Erase Titles Window Status Page Hide
Western Marketing Division
Actual 1988
Actual 1989
Cost of Goods Sold
Operating Expenses
Total Operating Expenses
Income
F10

■ ***1-2-3* Release 3.1's** *Impress* add-in lets you format text and data without leaving the worksheet

Here's an update to our initial report on *1-2-3* Release 3.1 in last month's @Lotus column. In its formal announcement, Lotus said that *1-2-3* Release 3.1, which is scheduled to ship in the third quarter, will be followed in the fourth quarter by network versions of the program. An OS/2 version will be available three to four months after the DOS version ships, as will the Lotus Add-in Toolkit for Release 3.1. The updated Toolkit will support external C and assembly-language routines, which will make it easier for developers to port many *1-2-3* Release 2.*x* add-ins to Release 3.1.

Release 3.1 will also run under *Microsoft Windows* 3.0. Unlike *1-2-3* Release 3, the *Windows*-compliant Release 3.1 supports Microsoft's new DPMI (DOS protected-mode interface) specification, which means that it can access up to 16 megabytes of extended memory in *Windows*. You'll also be able to launch the program from a *Windows* icon and use the *Windows* clipboard to move data between applications, but Release 3.1 won't provide the pull-down menus, dialogue boxes, resizable windows, and dynamic data exchange of a true *Windows* application. However, Lotus has announced its intention to produce a fully adapted *1-2-3* for *Windows*.

1-2-3 Release 3.1 will maintain keystroke, menu, and data compatibility with Releases 2.2 and 3. Release 3.1 will also support *1-2-3*'s PIC format, *Freelance Plus*'s CGM format, the ALL format used in *1-2-3* Release 2.2 with *Allways*, and *Impress's* FMT format. The upgrade will include new drivers for the Hewlett-Packard LaserJet IIP and III, Canon LBP, and Xerox 4045 printers, as well as four Bitstream typeface families and support for Bitstream downloadable fonts.

To run *1-2-3* Release 3.1, you need an IBM, Compaq, or compatible 80286- or 80386-based computer, a hard disk, 1 megabyte of available RAM, and DOS 3.0 or higher. The OS/2 version will require 3 megabytes of RAM and OS/2 version 1.1 or higher.

1-2-3 Release 3.1 will retail for $595. Those who buy Release 3 between May 7, 1990, and 30 days after Release 3.1 ships may upgrade to Release 3.1 free until December 31, 1990. For those who bought Release 3 before May 7, 1990, the upgrade charge is $35. *1-2-3* Release 2.2 users may upgrade for $75 until December 31, 1990. Users of *1-2-3* Release 2.01 and earlier releases may upgrade for $150.

Lotus and PC Publishing, an independent company founded by the creators of *Impress*, are working together to incorporate *Impress* into other versions of *1-2-3*. In the meantime, PC Publishing will distribute the *Impress* add-in for *1-2-3* Release 2.*x*.

Agenda Release 2.0 on the Way

Lotus announced Release 2.0 of *Lotus Agenda*, the company's personal-information manager. The DOS version of *Agenda* 2.0 is due out this summer; network editions and an OS/2 version will follow.

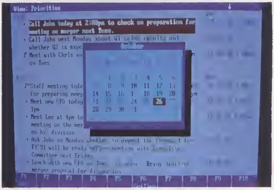
Lotus claims that the new release will be much easier to learn than the original. In fact, the company guarantees it: If you're not up and running with *Agenda* Release 2.0 in 30 minutes, Lotus will refund your money. To help users get going, *Agenda* 2.0 will offer redesigned documentation, a tutorial program that lets users enter their own information, as well as four modifiable "starter" applications: Activities Planner, Account Manager, People Manager, and Information Sifter.

The program sports a revamped menu structure that is more consistent from task to task, and it has more flexible date and time features. For example, *Agenda* 2.0 offers a pop-up calendar and can interpret a wider variety of time designations. It can also display daily, weekly, monthly, or quarterly schedules, in formats similar to pocket diaries, and can print them on the tiny pages that fit in a diary.

An enhanced macro facility lets you define keys and customize menus, and the addition of basic column math lets you track expenses, for example, or make budget projections. Other new features include pop-up settings boxes and support for PostScript printers.

Agenda runs under DOS 2.1 or higher on IBM PCs, PS/2s, and certified compatibles with a hard disk and at least 640K of RAM. *Agenda* 2.0 will include Lotus's file-reservation system, which will let *Agenda* users share files in a networked environment. Lotus plans to offer Node and Server licensing options at a later date.

Agenda 2.0 will be available from Lotus-authorized dealers for a suggested retail price of $395. The price of an upgrade is $99; however, those who acquire *Agenda* 1.0 or 1.01 from May 21, 1990, through 30 days after *Agenda* 2.0 ships will be able to upgrade for $30.


View: Priorities
Call John today at 2:00pm to check on preparation for meeting on merger next Tues.
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10

■ **New date features** in *Agenda* 2.0 include a pop-up calendar and schedule displays in daily, weekly, monthly, or quarterly format

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Don't Retype... Replicate

The Copy command eases data-entry chores.

BY DANIEL GASTEIGER

A worksheet often contains data in one location that must also appear elsewhere in the worksheet. For example, in a database, the field names entered as part of the Input range must also appear in the Criterion and Output ranges. Retyping entries not only wastes time but it threatens to introduce errors that may affect a model's performance.

The Copy command is specifically designed to duplicate worksheet data. You issue the command and instantly, *1-2-3* can copy hundreds of cells to a new location. In *1-2-3* Releases 2.01 and 2.2, that location will be on the same worksheet. But in *1-2-3* Release 3, the destination might even be another worksheet or file currently in memory.

SINGLE CELLS ARE SIMPLE

At its simplest, the Copy command duplicates the contents of a source cell in a target cell. When you press the slash key and select Copy, *1-2-3* prompts you to specify a source range, which is the cell or range of cells containing the data you want to copy. Then *1-2-3* prompts you to specify a target range, which is the cell or range of cells where you want the copied data to appear.

Try the Copy command. Enter the value *7* in cell A1 of a blank worksheet. Leave the cell pointer in cell A1. To copy the value in cell A1 to cell B1, press the slash key and select Copy from the main menu.

1-2-3 prompts you to specify the range to copy from and offers the current cell, range A1..A1, as the default. Press Return to accept that range.

Next, *1-2-3* prompts you to specify the range to copy to and offers cell A1 as the default target range. The target default is always a single cell reference to the cell that currently contains the cell pointer. Press the RightArrow key once to highlight cell B1 and then press Return. The number 7 appears in cell B1 and the cell pointer returns to cell A1. After completing a copy operation, the cell pointer always returns to the cell it was in when you issued the Copy command. In a moment, we'll explore this phenomenon further.

Try the command again. Select /Copy and press Return to accept cell A1 as the range to copy from. Then type *C1* and press Return. The number 7 appears in cell C1. You can specify the source and target ranges either by highlighting a cell or a range of cells, a process also known as pointing, or by entering a single cell address or a range address.

ONE FOR ALL

Suppose you want to copy the contents of one cell to a range of cells. The Copy command accomplishes that in a single pass. Enter a backslash and an equal sign (\=) in cell A2, and a double-dashed line appears. Now use the Copy command to extend that line as needed across the worksheet.

With the cell pointer in cell A2, select /Copy and press Return to accept cell A2 as the range to copy from. Then press the RightArrow key once to move the cell pointer to cell B2. Don't press Return yet. Instead, press the period key. Notice that the reference in the control panel changes from the single cell reference B2 to the single-cell range reference B2..B2. Pressing the period key "anchors" the pointer in the current cell. Now press the RightArrow key to expand the highlighted range one cell to the right. The control-panel reference now reads B2..C2. Press Return to accept that as the range to copy to. The dashed line now extends across three columns.

ALL FOR ONE

When copying a range of cells, you can use a shortcut to indicate the target range. To see how this works, make a copy of the cells in range A1..C2.

Move the cell pointer to cell A1. Then select /Copy, press the RightArrow key twice, press the DownArrow key once, and press Return. Doing so specifies range A1..C2 as the range to copy from.

Move the cell pointer to cell A3 and press Return to specify that cell as the range to copy to. Starting in cell A3, a copy of the entire source range appears. When copying a range of cells, you need to specify only the upper-left cell of the target range.

COPY ROWS OR COLUMNS

The Copy command rapidly makes multiple copies of entire rows and columns. Try it. Move the cell pointer to cell A3 and select /Copy. Press the RightArrow key twice

CYNDY PATRICK

to highlight range A3..C3 and press Return. Now press the DownArrow key twice and press the period key to anchor the cell pointer. Press the DownArrow key twice to highlight range A5..A7 and press Return. *1-2-3* copies row 3 to rows 5, 6, and 7.

Now try it again. Move the cell pointer to cell C1, select /Copy, and specify range C1..C7 as the range to copy from. Then press the RightArrow key once, press the period key to anchor the cell pointer, and press the RightArrow key twice. Press Return to specify range D1..F1 as the range to copy to.

CELL POINTER ROUND-TRIP

Perhaps you noticed that at the beginning of each of the previous Copy operations, the cell pointer was positioned in the upper-left cell of the source range. Starting with the cell pointer in that position makes highlighting the source range a snap. But what if you need to copy data to the area of the spreadsheet where you're currently working? Moving the cell pointer to the source range, issuing the Copy command, and moving the cell pointer back to the newly copied data requires excessive labor.

Instead, begin the Copy command with the cell pointer already at the target destination. Move the cell pointer to cell A9. Select /Copy, and *1-2-3* presents range A9..A9 as the default range to copy from. Reduce this range reference to a single cell reference by pressing the Escape key or the Backspace key once. Next, move the cell pointer to cell A1, press the period key to anchor the cell pointer, and then highlight range A1..F7. When you press Return, *1-2-3* offers cell A9 as the range to copy to. Press Return. The desired data appear in range A9..F15, and the cell pointer ends its journey in cell A9.

PRACTICE COPYING

The worksheet used in this discussion isn't particularly useful. But before you erase it, spend a little more time with the Copy command. Make sure that you understand how to perform each of the following copy operations:

Copy a single cell to a single cell.
Copy a single cell to a range of cells.
Copy a range of cells to a single cell.
Copy a row of data to several rows.
Copy a column of data to several columns.

Also, practice copying cells by pointing to source and target ranges and by entering cell or range addresses. Finally, issue the Copy command several times, starting with the cell pointer in the source location. Then use the command a few more times, starting with the cell pointer in the target location. ■

Daniel Gasteiger is a *1-2-3* and *Symphony* consultant in Boston and a contributing editor to *LOTUS*.

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Parsing the Unparsable

Create a macro to convert any ASCII file into a usable worksheet.

BY WILLIAM J. TASTLE

When you import an ASCII file into *1-2-3* using the File Import Text command, each record in the file becomes a long label in a single cell. To use the imported data, you must split up the labels and place words and numbers in separate cells. Many files contain such a mixture of text and numbers that it is virtually impossible to "de-label" them. The Data Parse command is the only built-in way to split up a long label into separate cell entries. But using this command can be a nightmare.

The Data Parse command must read in the entire input file before it can parse it. Thus, two copies of the file are in memory at once: the original file and the parsed file. If the file is large, the conventional limitations of DOS can bring the parsing to an abrupt halt when *1-2-3* uses up all available RAM. Also, you may have to adjust column widths after the parse. And you may have to recreate line separators, such as dashed lines, which are common in business reports.

Fortunately, you can create your own data-parse command. The macro described here runs in *1-2-3* Releases 2.01, 2.2, and 3. It parses an ASCII file of any length and formats cells as currency, percentages, punctuated values, or decimals. The macro uses advanced file commands such as {READLN} and {GETPOS} and then performs string arithmetic with the @FIND and @REPLACE string functions.

The parse macro breaks a line of text into separate entries at each space character. Thus, the macro enters each word and number of the text file into a separate cell.

THE MACRO CODE

Enter all labels shown in figures 1 and 2. Preface the entries in cells C2, C7, C14, and A23 with an apostrophe. Omit for now the text printed in color. These are string formulas that you'll enter in a moment. To assign the labels in column A as range names for the adjacent cells in column B, move the cell pointer to cell A1, select /Range Name Labels Right, highlight the cells in range A1..A80, and press Return.

Enter the following formulas:

Cell	***Formula***
B25	+"{OPEN ""''&flname&''"",R}{BRANCH filerror}"
B35	+"{LET "&@CELLPOINTER("address")&", @LEFT(line,next)}"

Save the worksheet file using the File Save command, and call it PARSE. Then exit to DOS.

To test the macro, use an ASCII file that you've been trying to parse, or create a new one. You can create an ASCII file easily. Make sure you're in the default *1-2-3* directory. Then type *copy con ascii.txt* and press Return. Type the following text; press Return at the end of each line, but do not use the Tab key for spacing:

Dan,

Here are the results of our program.

Sales	**Jan**	**Feb**	**Mar**	**Total**
Janice	$64,312	$91,737	$88,937	$244,986
Gail	$67,033	$16,981	$140	$84,154
Frank	$3,961	$53,679	$41,048	$98,688

Time-equivalent factor

Janice	**Gail**	**Frank**
0.71	0.9	0.23

Bonuses

Janice	$17,394
Gail	$7,574
Frank	$2,270

Should we make Janice a partner?

Ann

Don't worry about aligning columns or about the number of spaces between words and numbers. The macro ignores all but the first space character. Press the F6 key, and press Return to save the file. Then restart *1-2-3* and retrieve the PARSE worksheet you just saved.

Move the cell pointer to cell I1 so that you don't overwrite anything when you import the ASCII file. Now run the macro by holding down the MACRO key (Alt on most computers) and pressing P. The macro prompts you to enter the name of a file. Enter *ascii.txt*. The macro asks you if the cell pointer is in a good place for data import. Since it is, press Return. The macro imports and parses the file.

Here's how the macro works:

{GETLABEL "Enter name of file to parse: ",flname} prompts you for the name of the ASCII file you wish to parse and stores your response in the cell named *flname*.

{RECALC loop1} recalculates the string formula in the cell named *loop1* (cell B25). That formula returns a string that tells the macro to open your file as read-only. If the file does not exist, the macro calls the *filerror* routine. This routine prompts you for another file name and then loops back to the *loop1* routine. The macro continues to prompt you for a file name until it finds the file you specify.

{loc_curs}{PANELOFF}{WINDOWSOFF} calls the routine named *loc_curs*. This routine asks you if the cell pointer is in the leftmost cell of the area into which you want to import the ASCII file. If it isn't, you can move the cell pointer. The macro then freezes the screen display.

{LET start,loc} copies the cell address from the cell named *loc* to the cell named *start*.

{FILESIZE size} determines the number of bytes in the input file and enters that number in the cell named *size*.

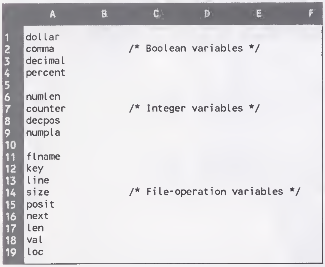
{READLN line} reads the first line of the input file.

{GETPOS posit} enters the current file-pointer position in the cell named *posit*.

{IF size=posit#AND#line=""}{PANELON}{WINDOWSON}{QUIT} halts macro processing if the file contains no data to import.

{LET line,@TRIM(line)&" "} starts the *loop1* routine by removing extra space characters from the label in the cell named *line* and by adding one space to the end of the label. Because the macro uses a single space character as a delimiter, there has to be one at the end of the line.

{clear} presets all Boolean variables to "false" and all integer variables to 0. Though "false" and 0 are equivalent in Boolean terms, using the @FALSE and @TRUE formulas helps clarify the coding.



```
     A          B        C         D         E          F
1   dollar
2   comma              /* Boolean variables */
3   decimal
4   percent
5
6   numlen
7   counter            /* Integer variables */
8   decpos
9   numpla
10
11  flname
12  key
13  line
14  size               /* File-operation variables */
15  posit
16  next
17  len
18  val
19  loc
```

Figure 1: Single-cell ranges provide variables for the macro program.

{LET next,@FIND(" ", line,0)}{RECALC form1} locates the next space in the input line stored in *line* and enters that position into the cell named *next*. The macro then recalculates the string formula in the cell named *form1*.

The string formula in *form1* (cell B35) does some string arithmetic. It extracts that portion of the input line from the first position (position 0) to the first space and stores that string in the current cell.

THE DATA PARSE COMMAND MUST READ IN THE ENTIRE INPUT FILE BEFORE IT CAN PARSE IT.

{LET val,@VALUE(@CELLPOINTER("contents"))} enters the value of the current cell in the cell named *val*.

{IF @CELLPOINTER("contents")=""}{LET val,""} examines the contents of the current cell. If it contains a null string, the macro enters a null string in *val*.

{IF @ISNUMBER(val)#AND##NOT#@ISERR(val)}{testval} uses the functions @ISNUMBER and @ISERR to determine whether *val* contains a number. The macro checks for an ERR value, because @ISNUMBER evaluates an ERR value as "true." If *val* contains a value, the macro calls the routine *testval*. That routine examines all the characters in the current cell to determine how it should be formatted (see the description of *testval* on page 23.)

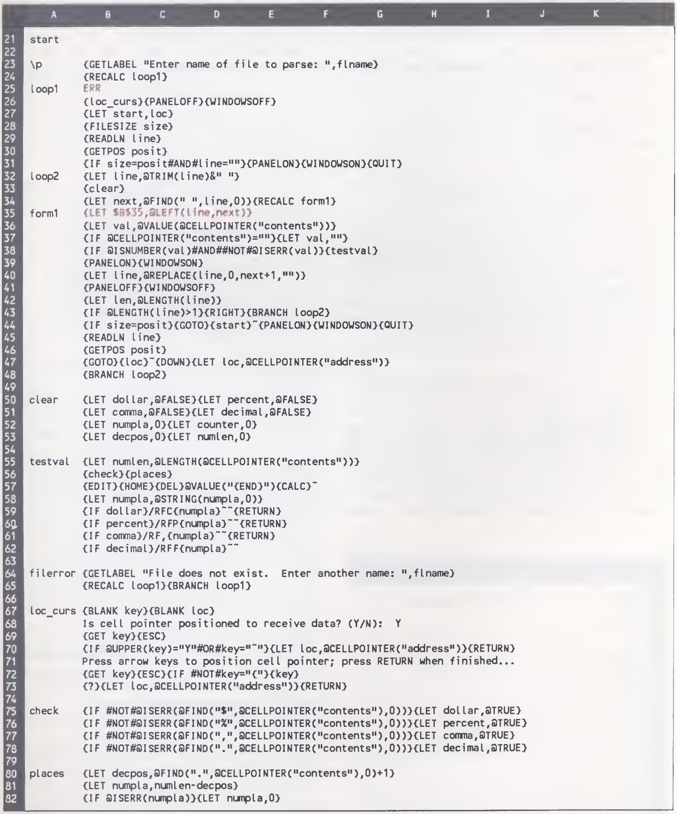
{PANELON}{WINDOWSON} turns the screen display back on.

{LET line,@REPLACE(line,0,next+1,"")} replaces the label in *line* with the same label minus the string that was just evaluated. The @REPLACE formula eliminates the portion of the label already evaluated by using a null string as the replacement-string argument.

{PANELOFF}{WINDOWSOFF} freezes the on-screen display.

{LET len,@LENGTH(line)} calculates the number of characters in the label in *line* and stores that value in the cell named *len*.

{IF @LENGTH(line)>1}{RIGHT}{BRANCH loop2} determines whether there is any more data to process in *line*. If there is, the macro moves the cell pointer one column to the right and calls the *loop2* routine.



```
    A        B         C         D         E         F         G         H         I         J         K
21  start
22
23  \p       {GETLABEL "Enter name of file to parse: ",flname}
24           {RECALC loop1}
25  loop1    ERR
26           {loc_curs}{PANELOFF}{WINDOWSOFF}
27           {LET start,loc}
28           {FILESIZE size}
29           {READLN line}
30           {GETPOS posit}
31           {IF size=posit#AND#line=""}{PANELON}{WINDOWSON}{QUIT}
32  loop2    {LET line,@TRIM(line)&" "}
33           {clear}
34           {LET next,@FIND(" ",line,0)}{RECALC form1}
35  form1    {LET $B$35,@LEFT(line,next)}
36           {LET val,@VALUE(@CELLPOINTER("contents"))}
37           {IF @CELLPOINTER("contents")=""}{LET val,""}
38           {IF @ISNUMBER(val)#AND##NOT#@ISERR(val)}{testval}
39           {PANELON}{WINDOWSON}
40           {LET line,@REPLACE(line,0,next+1,"")}
41           {PANELOFF}{WINDOWSOFF}
42           {LET len,@LENGTH(line)}
43           {IF @LENGTH(line)>1}{RIGHT}{BRANCH loop2}
44           {IF size=posit}{GOTO}{start}~{PANELON}{WINDOWSON}{QUIT}
45           {READLN line}
46           {GETPOS posit}
47           {GOTO}{loc}~{DOWN}{LET loc,@CELLPOINTER("address")}
48           {BRANCH loop2}
49
50  clear    {LET dollar,@FALSE}{LET percent,@FALSE}
51           {LET comma,@FALSE}{LET decimal,@FALSE}
52           {LET numpla,0}{LET counter,0}
53           {LET decpos,0}{LET numlen,0}
54
55  testval  {LET numlen,@LENGTH(@CELLPOINTER("contents"))}
56           {check}{places}
57           {EDIT}{HOME}{DEL}@VALUE("{END}"){CALC}~
58           {LET numpla,@STRING(numpla,0)}
59           {IF dollar}/RFC{numpla}~~{RETURN}
60           {IF percent}/RFP{numpla}~~{RETURN}
61           {IF comma}/RF,{numpla}~~{RETURN}
62           {IF decimal}/RFF{numpla}~~
63
64  filerror {GETLABEL "File does not exist.  Enter another name: ",flname}
65           {RECALC loop1}{BRANCH loop1}
66
67  loc_curs {BLANK key}{BLANK loc}
68           Is cell pointer positioned to receive data? (Y/N):  Y
69           {GET key}{ESC}
70           {IF @UPPER(key)="Y"#OR#key="~"}{LET loc,@CELLPOINTER("address")}{RETURN}
71           Press arrow keys to position cell pointer; press RETURN when finished...
72           {GET key}{ESC}{IF #NOT#key="{"}{key}
73           {?}{LET loc,@CELLPOINTER("address")}{RETURN}
74
75  check    {IF #NOT#@ISERR(@FIND("$",@CELLPOINTER("contents"),0))}{LET dollar,@TRUE}
76           {IF #NOT#@ISERR(@FIND("%",@CELLPOINTER("contents"),0))}{LET percent,@TRUE}
77           {IF #NOT#@ISERR(@FIND(",",@CELLPOINTER("contents"),0))}{LET comma,@TRUE}
78           {IF #NOT#@ISERR(@FIND(".",@CELLPOINTER("contents"),0))}{LET decimal,@TRUE}
79
80  places   {LET decpos,@FIND(".",@CELLPOINTER("contents"),0)+1}
81           {LET numpla,numlen-decpos}
82           {IF @ISERR(numpla)}{LET numpla,0}
```

Figure 2: The parsing macro uses advanced file commands such as {READLN} and {GETPOS}. The macro avoids the {BRANCH} command except to call the *loop2* routine and to handle file-opening errors, if they occur. Thus, the code is easier to understand and modify.

{IF size=posit}{GOTO}{start}~{PANELON}{WINDOWSON}{QUIT} checks whether the macro has read in the entire ASCII file. If it has, the macro moves the cell pointer back to the cell in which you started the macro and turns the screen display back on. Macro processing then stops.

{READLN line} reads the next line of the input file.

{GETPOS posit} enters the current file-pointer position in the cell named *posit*.

{GOTO}{loc}~{DOWN}{LET loc,@CELLPOINTER("address")} moves the cell pointer to the address that is specified in *loc*. The macro then moves the cell pointer down one row and enters that address in *loc*.

{BRANCH loop2} loops back to the top of the *loop2* routine.

The *testval* procedure determines the appropriate format for each cell entry. Here's how it works:

{LET numlen,@LENGTH(@CELLPOINTER("contents"))} enters the character length of the current cell in the cell named *numlen*.

{check}{places} calls the *check* routine, which examines the contents of the current cell. If the current cell contains a dollar sign, percent sign, comma, or decimal point, the *check* routine enters *@TRUE* in *dollar*, *percent*, *comma*, or *decimal* (the Boolean variables). The macro then calls the *places* routine, which determines how many decimal places the value has and enters that amount in the cell named *numpla*.

{EDIT}{HOME}{DEL}@VALUE("{END}"){CALC}~ enters the value of the current cell in the current cell.

{LET numpla,@STRING(numpla,0)} changes the value in *numpla* to its label equivalent.

{IF dollar}/RFC{numpla}~~{RETURN} formats the current cell for currency if *dollar* is "true." The macro uses the label in *numpla* to specify the number of decimal places. It then returns control to the calling routine.

If *dollar* is "false," processing continues on the next line. The rest of the routine works the same way. The macro processes each line of the routine until it finds a "true" value for *percent*, *comma*, or *decimal*. It then formats the current cell accordingly.

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CIRCLE 106 ON READER SERVICE CARD

Building a Fast Megadatabase

Advanced hashing techniques quickly search through a million records.

BY NICHOLAS DELONAS

The problem is almost too big to imagine. The boss needs a database model that can handle 100,000 records. That's more data than can fit in RAM. To make matters worse, record retrieval must be fast–faster than the average off-the-shelf database package.

Impossible? Not at all. *1-2-3* Releases 2.01, 2.2, and 3 can tackle this challenge, albeit with some restrictions. The secret is to use a technique called hashing.

First, a warning. Hashing databases is not for the faint of heart. Only power users should dare proceed.

Hashing is one of the methods for speeding data access in large databases. To better understand the technique, we'll contrast it with the more familiar method of indexing. Like the index in a book, database indexes use a separate, sorted list to help you find entries in the main file. Even if you didn't organize your data in alphabetical or numerical order, the index file lets you work with your database file as if you had. (See the April 1989 1-2-3 Macros column on using a spreadsheet to index records.)

Rather than use an index stored in a separate file to locate records, hashing uses the contents of each record to organize the file itself. According to *File Structures: A Conceptual Toolkit* (Addison-Wesley Publishing Co., 1987), by Michael J. Folk and Bill Zoellick, the hashing technique applies a mathematical function to the primary key of each record in order to generate what appears to be a random file address for that record. The primary key is simply a field that uniquely identifies a record. Although each primary key yields a specific file address, the hash function spreads record addresses as evenly as possible across the hash file.

THE KEY CONCEPTS

Hashing requires every record to have a primary key, which is a unique identifier, such as a Social Security number or stock number. Hashing also requires fixed-length records. Furthermore, the hash file must be created before entering records, unlike other record-storage techniques.

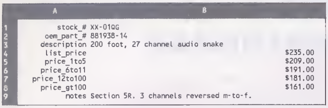
For example, you could set up a file that has room for 100 employee records. One field in each record will contain the employee's Social Security number. That field will be the primary key. The simplest hashing method would take the modulus of the Social Security number divided by the number of available slots for records. This would provide addresses for storing each record. For the Social Security number 149-56-0020, the formula @MOD(149560020,100) yields 20. That employee's record would be in slot number 20. If each record contains 100 characters, the record's address is simply 100*20, or 2,000 bytes from the beginning of the file.

DRAWBACKS

Hashing isn't a new technique. For years, airline-reservations systems have used hashing algorithms to access flight records quickly. For worksheet developers, hashing provides a fast way to locate records on disk. But there are drawbacks. Hashing gains speed, in the form of rapid insertion and deletion of records, at the expense of disk space and flexibility. The requirement for fixed-length records means wasted disk space within each record because shorter records must be filled out with space characters. And since no hash file should be filled to capacity, there is always wasted disk space between records. Furthermore, you can't sort a hash file, and in most instances you can't search for a record by using an alternative field. Also, it's difficult to change the size of a hashed file that contains data. So you need to be certain that the number of records in the file will never exceed a predefined limit.

There's another problem with hashing. When two different records hash to the same address, the model has to search for an alternative place to put the second record. In the example of the records containing Social Security numbers, a record with the number 525-34-9920 would hash to the same address as 149-56-0020, 2,000 bytes from the beginning of the file. A good hashing system minimizes such record collisions by dedicating a lot of disk space to the database and by making the addresses large enough to hold more than one record.

Addresses that hold more than a single record are called buckets. Buckets are to single-record addresses what multifamily dwellings are to single-family homes–more than one record can reside at the same address. The mathematics behind using buckets rather than storing one record per logical address are beyond the scope of



```
              A                              B
1      stock_# XX-01QG
2    oem_part_# 881938-14
3   description 200 foot, 27 channel audio snake
4    list_price                                        $235.00
5    price_1to5                                        $209.00
6   price_6to11                                        $191.00
7 price_12to100                                        $181.00
8   price_gt100                                        $161.00
9         notes Section 5R. 3 channels reversed m-to-f.
```

FIGURE 1. This screen shows the data-entry and retrieval area of a parts database for an electronics supplier.

this article. Suffice it to say that buckets dramatically reduce the number of records that overflow into address slots other than the addresses to which they hashed.

Again, unlike indexing, hashing generates addresses that appear to be random. There is no obvious connection between a primary key and the location of the corresponding record in the hash file. In fact, the more random the results of your hash function, the better the performance. A good randomizing hash function spreads records evenly across a file. That results in fewer records that hash to the same address.

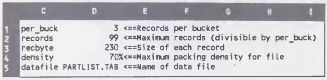
Finally, test hashing models thoroughly before using them in a real-world operation. The consequences of bugs in models that manipulate megadatabases can be dire. Be sure to back up your files frequently.

A BUSINESS CHALLENGE

Consider the problem of setting up a parts database for a popular-electronics wholesaler to improve the productivity of clerks responding to inquiries. The owner of the wholesaler wants to avoid a major capital investment for an inventory-management system. The inventory manager already has a PC and uses *1-2-3* for scheduling. He hires you to create a database to help him find stock numbers quickly. He assures you that because of a variety of business restrictions and strategies, the parts database will never exceed 10,000 records. The PC's hard disk has 33 megabytes free. He agrees that the data fields shown in figure 1 (A1..A9) fulfill his needs.

Because a hashed 10,000-record database takes up more than 3 megabytes of hard-disk space, for testing purposes, first create a model to handle 100 records.

To build this model, set the column widths of a blank worksheet as follows: A, 17; B, 55; and D, 13. Enter the labels in range A1..A9 as shown in figure 1. Remove protection from range B1..B9. Use the Range Name Labels Right command to assign the labels in range A1..A9 as range names for the adjacent cells in column B. Use the Range Label Right command to right-align the labels in range A1..A9. Format range B4..B8 as Currency with two decimal places. Assign the range name *rest* to range B2..B9 and the range name *dataentry* to range A1..B9.



```
  C               D          E         F        G        H       I
1 per_buck              3 <==Records per bucket
2 records              99 <==Maximum records (divisible by per_buck)
3 recbyte             230 <==Size of each record
4 density             70%<==Maximum packing density for file
5 datafile PARTLIST.TAB <==Name of data file
```

FIGURE 2. The table for setting up the parameters of the database. Once you decide on the specific parameters, you cannot change them later without rebuilding the file and reentering all records.

Since the whole hash file must be created before you enter any records, enter the labels and values as shown in figure 2. Assign the labels in column C as range names for the adjacent cells in column D. Assign the Percent format with zero decimal places to cell D4.

The table in figure 2 helps you decide how to set up the database. The formulas and macros in the model will use the values you enter in this table.

For testing purposes, use PARTLIST.TAB as a test file that can hold as many as 100 records. The bucket size (*per_buck*) is 3 records. The maximum number of records is 99 instead of 100 because each bucket holds 3 records and the maximum number of records must be divisible by the number of records in each bucket. The record size (*recbyte*) is 230. The following table shows the breakdown of the record size:

Field Name	Bytes	Field Name	Bytes
stock_#	7	*price_6to11*	11
oem_part_#	9	*price_12to100*	11
description	59	*price_gt100*	11
list_price	11	*notes*	100
price_1to5	11		

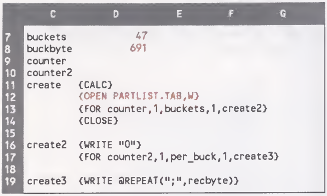
A packing density of 70% means that if the database is filled with the maximum number of records, those records will use 70% of the available space. If the density is lower, say 50%, more disk space is occupied and speed improves. If the density is higher, say 90%, less disk space is occupied but speed suffers. Start with 70% target density and see what happens.

HOW TO PRODUCE THE HASH FILE

Create the macro in figure 3 on the next page.

The items printed in color are the result of formulas. Enter the formula @ROUND((records/per_buck)/density,0) in cell D7. Next, enter the formula (recbyte*per_buck)+1 in cell D8. Then enter the formula +"{OPEN "&$datafile&",W}" in cell D12. Assign the labels in range C7..C19 as range names for the adjacent cells in column D.

Run the *create* macro to create and set up the file PARTLIST.TAB so that it contains 47 buckets. Release 2.01 users need to create a single-letter macro to call the *create* routine. Just be careful not to call the routine accidentally later—to do so would erase all your records.



```
     C          D              E          F          G
 7   buckets           47
 8   buckbyte         691
 9   counter
10   counter2
11   create   {CALC}
12            {OPEN PARTLIST.TAB,W}
13            {FOR counter,1,buckets,1,create2}
14            {CLOSE}
15
16   create2  {WRITE "0"}
17            {FOR counter2,1,per_buck,1,create3}
18
19   create3  {WRITE @REPEAT(";",recbyte)}
```

FIGURE 3. These routines create the blank hash file PARTLIST.TAB. They erase the old file if it exists.

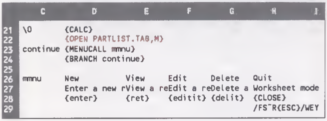
The first character in each bucket is a number that tells how many records are in the bucket. This number is the bucket number. At first, each bucket consists of a zero followed by 690 semicolons. The zero indicates the bucket is empty. The semicolons fill out the empty bucket.

BUILDING THE MODEL

A good place to start with a problem like this is by creating custom menus. The model has to be able to accept new records and allow you to delete or modify old records. To this end, enter labels as shown in figure 4, omitting for now the text printed in color. Because of the complexity of this model, be sure to check your entries.

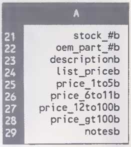
Assign the macro range names. Then enter the formula +"{OPEN "&$datafile&",M}" in cell D22. The labels in range D27..G27 are *Enter a new record, View a record, Edit a record,* and *Delete a record*, respectively. Remember to initiate the hash file with the *create* macro before running the auto-executing macro. You can also assign another range name to the \0 routine, such as *m*, so that you can start the macro from the worksheet.

Next, write a macro to enter a record into the hash file. But before the model can transfer a record from the data-entry area to the hash file, it must fill out the fields with space characters to create a fixed-length record format. The {CONTENTS} command provides a convenient way to do that. Enter labels as shown in the figure at the right.



```
     C        D          E          F          G          H          I
21   \0       {CALC}
22            {OPEN PARTLIST.TAB,M}
23   continue {MENUCALL mmnu}
24            {BRANCH continue}
25
26   mmnu     New        View       Edit       Delete     Quit
27            Enter a new rView a reEdit a reDelete a Worksheet mode
28            {enter}    {ret}      {editit}   {delit}    {CLOSE}
29                                                        /FS~R{ESC}/WEY
```

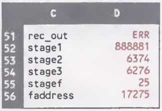
FIGURE 4. The auto-executing macro opens the hash file and calls a custom menu for the hashing model.



```
                  A
21          stock_#b
22       oem_part_#b
23      descriptionb
24        list_priceb
25        price_1to5b
26       price_6to11b
27     price_12to100b
28      price_gt100b
29            notesb
```

These labels are the same as the labels in range A1..A9, except for the letter *b* that is appended to each. Assign these labels as range names for the adjacent cells in column B. Then enter the labels shown in figure 5 and assign the macro range names.

The *a_to_b* routine takes your input and enters it as fixed-length labels in range B21..B29. The *b_to_a* routine takes the fixed-length labels and converts them back into the variable-length labels and values in range B1..B9.



```
     C               D
51   rec_out        ERR
52   stage1      888881
53   stage2        6374
54   stage3        6276
55   stagef          25
56   faddress     17275
```

Now you're ready to create the hashing function. Enter the labels shown in the figure at the left, omitting text printed in color. Assign labels in column C as range names for the adjacent cells in column D.

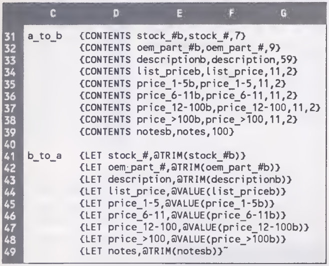
Enter the following formulas:

Cell	***Formula***
D51	+stock_#b&oem_part_#b&descriptionb&list_priceb &price_1to5b&price_6to11b&price_12to100b& price_gt100b&notesb
D52	@VALUE(@STRING(@CODE(@LEFT(stock_#,1)),0)& @STRING(@CODE(@MID(stock_#,1,1)),0)&@STRING (@CODE(@MID(stock_#,5,1)),0))
D53	@MOD(stage1+@VALUE(@STRING(@CODE(@MID (stock_#,3, 1)),0)&@STRING(@CODE(@MID (stock_#,4,1)),0))*@MOD(stage1,buckbyte), buckets*buckbyte)
D54	@MOD(stage2+@VALUE(@STRING(@CODE(@MID (stock_#,5,1)),0)&@STRING(@CODE(@MID (stock_#,6,1)),0))*@MOD(stage2,buckbyte), buckets*buckbyte)
D55	@MOD(stage3,buckets)
D56	+stagef*buckbyte

These formulas return ERR until you enter a record in range B1..B9. Assign the name *block* to range D51..D56.

The formula in cell D51 is simply a concatenation of the labels in range B21..B29. It lets your macro write an entire record at once. The formulas in range D52..D55 work together to yield a bucket address in cell D56. If the label in cell B1 is *XX-01QG*, the formula in D56 yields the bucket address of 22,803 bytes from the start of the file.

The formula in the cell named *stage1* yields a value that is the result of concatenating the Lotus International



```
     C         D        E        F        G
31  a_to_b   {CONTENTS stock_#b,stock_#,7}
32           {CONTENTS oem_part_#b,oem_part_#,9}
33           {CONTENTS descriptionb,description,59}
34           {CONTENTS list_priceb,list_price,11,2}
35           {CONTENTS price_1-5b,price_1-5,11,2}
36           {CONTENTS price_6-11b,price_6-11,11,2}
37           {CONTENTS price_12-100b,price_12-100,11,2}
38           {CONTENTS price_>100b,price_>100,11,2}
39           {CONTENTS notesb,notes,100}
40
41  b_to_a   {LET stock_#,@TRIM(stock_#b)}
42           {LET oem_part_#,@TRIM(oem_part_#b)}
43           {LET description,@TRIM(descriptionb)}
44           {LET list_price,@VALUE(list_priceb)}
45           {LET price_1-5,@VALUE(price_1-5b)}
46           {LET price_6-11,@VALUE(price_6-11b)}
47           {LET price_12-100,@VALUE(price_12-100b)}
48           {LET price_>100,@VALUE(price_>100b)}
49           {LET notes,@TRIM(notesb)}~
```

FIGURE 5. Macro routines that convert fields from variable length to fixed length and vice versa

Character Set (LICS) codes for the first, second, and sixth characters in the cell named *stock_#*. The choice of which characters to concatenate initially was arbitrary.

The formula in the cell named *stage2* concatenates the LICS codes of the fourth and fifth characters. It then multiplies that value with the modulus of the result of the *stage1* formula divided by *buckbyte*. The formula then adds that result to the value returned by the formula in *stage1*. The formula takes the modulus of that value divided by the product of *buckets* and *buckbyte*.

The formula in the cell named *stage3* works much the same as the formula in *stage2*. The formula in *stagef* determines which bucket to put the record in by taking the modulus of the result of the formula in *stage3* divided by the value in the cell named *buckets*.

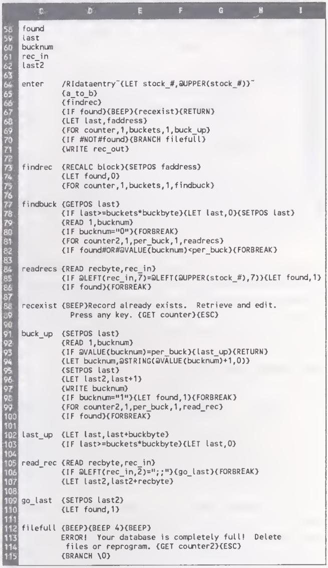
The formula in *faddress* determines the actual physical address by generating the byte offset of the bucket address.

Creating a hash function for any set of primary keys takes some thought and experimentation. This model uses a combination of popular hashing techniques. These formulas may be modified to suit individual needs.

ENTERING A RECORD

Figure 5 shows the macro for entering records into the PARTLIST.TAB file. The macro accepts data, searches the file to make sure the stock number doesn't already exist, and enters the new record in the correct bucket.

The *findrec* routine checks to see if the stock number already exists in the file by using the *findbuck* routine to read the first character in the bucket. If the number is zero, the macro knows that the record doesn't exist and thus returns control to the calling routine *enter*. If the number is not zero, the macro reads each of the records in the bucket to see whether any of them matches the current stock number. If the macro finds the stock number, it sets the value in *found* to one. It then returns control to the *enter* routine, which calls the *recexist* routine and returns macro control to the \0 routine.



```
     C        D          E        F        G        H        I
58  found
59  last
60  bucknum
61  rec_in
62  last2
63
64  enter    /RIdataentry~{LET stock_#,@UPPER(stock_#)}~
65           {a_to_b}
66           {findrec}
67           {IF found}{BEEP}{recexist}{RETURN}
68           {LET last,faddress}
69           {FOR counter,1,buckets,1,buck_up}
70           {IF #NOT#found}{BRANCH filefull}
71           {WRITE rec_out}
72
73  findrec  {RECALC block}{SETPOS faddress}
74           {LET found,0}
75           {FOR counter,1,buckets,1,findbuck}
76
77  findbuck {GETPOS last}
78           {IF last>=buckets*buckbyte}{LET last,0}{SETPOS last}
79           {READ 1,bucknum}
80           {IF bucknum="0"}{FORBREAK}
81           {FOR counter2,1,per_buck,1,readrecs}
82           {IF found#OR#@VALUE(bucknum)<per_buck}{FORBREAK}
83
84  readrecs {READ recbyte,rec_in}
85           {IF @LEFT(rec_in,7)=@LEFT(@UPPER(stock_#),7)}{LET found,1}
86           {IF found}{FORBREAK}
87
88  recexist {BEEP}Record already exists.  Retrieve and edit.
89             Press any key. {GET counter}{ESC}
90
91  buck_up  {SETPOS last}
92           {READ 1,bucknum}
93           {IF @VALUE(bucknum)=per_buck}{last_up}{RETURN}
94           {LET bucknum,@STRING(@VALUE(bucknum)+1,0)}
95           {SETPOS last}
96           {LET last2,last+1}
97           {WRITE bucknum}
98           {IF bucknum="1"}{LET found,1}{FORBREAK}
99           {FOR counter2,1,per_buck,1,read_rec}
100          {IF found}{FORBREAK}
101
102 last_up  {LET last,last+buckbyte}
103          {IF last>=buckets*buckbyte}{LET last,0}
104
105 read_rec {READ recbyte,rec_in}
106          {IF @LEFT(rec_in,2)=";;"}{go_last}{FORBREAK}
107          {LET last2,last2+recbyte}
108
109 go_last  {SETPOS last2}
110          {LET found,1}
111
112 filefull {BEEP}{BEEP 4}{BEEP}
113          ERROR!  Your database is completely full!  Delete
114           files or reprogram. {GET counter2}{ESC}
115          {BRANCH \0}
```

FIGURE 6. The cell variables and macro routines for entering a record into the hash file

If the macro doesn't find the record and the bucket number (*bucknum*) is less than the value in *per_buck*, the macro returns control to the *enter* routine. Under these circumstances, the macro knows that the record doesn't exist in the file.

If the first bucket is full and does not contain a record with the stock number, the *findrec* routine continues to search until it finds a matching record or a bucket that isn't full. If all the buckets are full, the macro searches every bucket. This would occur in the unlikely event that the file was full of records.

The *enter* routine then uses the *buck_up* routine to locate the next available slot for the current record. In most instances, that is one of the three slots in the bucket to which the record hashed. If the *buck_up* routine cannot find an available slot for the record, the macro branches to the *filefull* routine, which informs the user that the file is full.

Usually the *buck_up* routine is able to locate an available slot quickly. When it does, it increases the bucket number of the current bucket by one. The *enter* routine then writes the record into the available slot.

RETRIEVING A RECORD

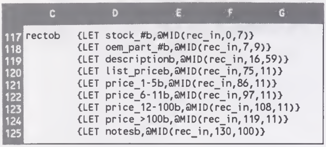
This model uses the cells named *rec_in* and *rec_out* to read and write entire records at once. You don't need to use this approach. A series of {READ} or {WRITE} statements would work. To read a record into memory all at once, a macro is needed to break the record into its parts. The routine below does the trick.

Now the problem of retrieving a record is simple to solve. And once the macro can retrieve a record, it's easy to delete it by simply writing over it with semicolons. The macro can also edit a record by first retrieving it and deleting it, then allowing the user to rewrite it by using the *enter* routine.

The routines for retrieving, editing, and deleting records are shown in figure 6. Note the *eddel* routine. Both the *editit* and *delit* routines use this routine after they read a record. The *eddel* routine writes over the first two characters of the record just read into *rec_in*. It then reduces the current bucket number by one. This effectively removes the record from the file.

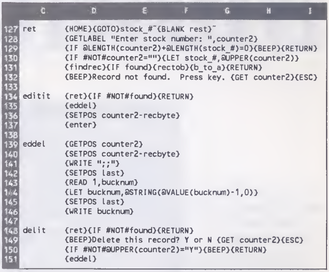
USING HASHING FOR YOUR OWN PROJECTS

To adapt this model to suit your needs, modify the *a_to_b*, *b_to_a*, and *rectob* routines. You may also have to develop your own hashing function by rewriting the formulas in the range named *block*. The hashing function in this model works for stock numbers of the form XX-XXXX. It doesn't use the third character as part of the randomization since, in this example, all stock numbers have the same third character.



```
117 rectob   {LET stock_#b,@MID(rec_in,0,7)}
118          {LET oem_part_#b,@MID(rec_in,7,9)}
119          {LET descriptionb,@MID(rec_in,16,59)}
120          {LET list_priceb,@MID(rec_in,75,11)}
121          {LET price_1-5b,@MID(rec_in,86,11)}
122          {LET price_6-11b,@MID(rec_in,97,11)}
123          {LET price_12-100b,@MID(rec_in,108,11)}
124          {LET price_>100b,@MID(rec_in,119,11)}
125          {LET notesb,@MID(rec_in,130,100)}
```

FIGURE 7. The *rectob* routine transfers a record from the cell named *rec_in*, breaking it into its separate fields.



```
127 ret      {HOME}{GOTO}stock_#~{BLANK rest}~
128          {GETLABEL "Enter stock number: ",counter2}
129          {IF @LENGTH(counter2)+@LENGTH(stock_#)=0}{BEEP}{RETURN}
130          {IF #NOT#counter2=""}{LET stock_#,@UPPER(counter2)}
131          {findrec}{IF found}{rectob}{b_to_a}{RETURN}
132          {BEEP}Record not found.  Press key. {GET counter2}{ESC}
133
134 editit   {ret}{IF #NOT#found}{RETURN}
135          {eddel}
136          {SETPOS counter2-recbyte}
137          {enter}
138
139 eddel    {GETPOS counter2}
140          {SETPOS counter2-recbyte}
141          {WRITE ";;"}
142          {SETPOS last}
143          {READ 1,bucknum}
144          {LET bucknum,@STRING(@VALUE(bucknum)-1,0)}
145          {SETPOS last}
146          {WRITE bucknum}
147
148 delit    {ret}{IF #NOT#found}{RETURN}
149          {BEEP}Delete this record? Y or N {GET counter2}{ESC}
150          {IF #NOT#@UPPER(counter2)="Y"}{BEEP}{RETURN}
151          {eddel}
```

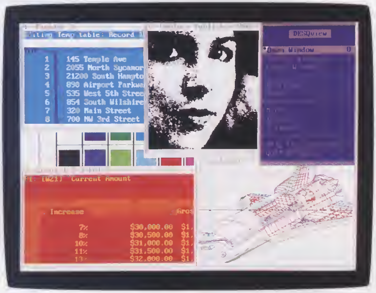
FIGURE 8. The macro routines for retrieving, editing, or deleting a record from the hash file

It is nearly impossible to achieve a uniform distribution by using a hash function. But a little experimentation often yields a hash function that spreads records out reasonably well. Experiment by loading 100 dummy records (or actual records if available) into the hash file, and then see how they're distributed. Some clustering is inevitable, so don't worry about that.

If you create a sample database of 100 records in the worksheet, you can automate the loading of dummy records. Simply modify the *enter* routine temporarily so that the command in cell D64 uses the Range Transpose command to transpose each dummy record from your temporary table to range B1..B9 and then moves the cell pointer down. Create a {FOR} loop that calls *enter* 100 times. Then position the cell pointer above the first record in the table and initiate the {FOR} loop to load the records into the hash file.

After you're satisfied that your model works well with the 100-record hash file, change the value in *records* to the number of records in the full file. Rerun the *create* routine to create the new hash file. Your model is then ready for actual data entry. Again, take care to make the hash file large enough, because it is difficult to change the file size later. If you do have to make a hash file larger, write a routine that reads each record sequentially from the start of the old hash file and then rehashes it to a new, larger hash file. This involves a lot of opening and closing of files and is likely to be quite time consuming. Try to avoid it. ■

Multitasking



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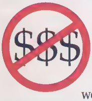

People all over the world are using DESQview to manage customized work environments like those shown here. They are using it to cut and paste data between programs running in multiple windows, running sorts and recalculations in the background, and they're operating in text and graphics modes in windows side-by-side.

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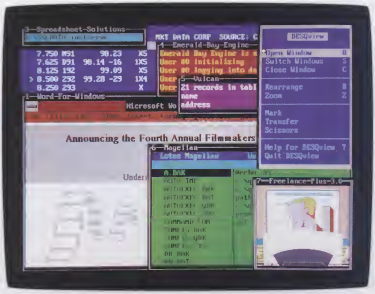

The vast majority of programs run in DESQview—even Windows 2.0 programs! And some programs take special advantage of DESQview to enhance their operation. FNN NewsReal and products using Spreadsheet Solutions' @DV 'Hot Links', for example, use windowing, multitasking and interprogram communications.

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CIRCLE 107 ON READER SERVICE CARD

How NCR Analyzes New-Product Payoff

Release 3 and the Add-In Toolkit make it easy for managers to look eight years ahead.

BY NICHOLAS DELONAS

At NCR Corp., the green light for a new-product venture pops on hundreds of times a year. But before top management throws the switch, it asks tough questions about expected profitability. Until recently, the answers were hard to come by. It was tough to probe all of the many business scenarios that might affect the bottom line.

That wasn't for want of trying. During the past 20 years, the Dayton (Ohio) computer maker has developed a series of sophisticated financial models for use in analyzing profitability. These models worked well compared with the more time-consuming manual methods used earlier. But they were still slow, and they lacked a real-time "what-if" capability.

That's all changed now. NCR has developed a powerful new PC-based program grounded in *1-2-3* Release 3 and buttressed with features developed using Lotus Add-In Toolkit for Release 3. One early user was Joe Gardner, a tall, lean business-planning manager in NCR's Financial Systems Development and Production Division. Gardner used to spend a lot of time building analyses with the old system. Now, he says, "we can spend more time working with the information."

With the new spreadsheet-based program, called *Quick Planner*, a marketing manager can enter assumed sales data for various marketing channels, such as computer stores, and quickly generate a financial report. A financial analyst in the development organization can then consolidate all pertinent marketing analyses, add data on product and development costs, and create the complete, corporate-level analysis. Both sets of users can set a financial goal and see what variables have to change for that goal to be reached. And both can project results up to eight years ahead.

Just as important, the program has reached a new group of users. Most of NCR's product

The two developers. John Maxwell and William Hahn in NCR's computer museum in Dayton, Ohio. They devised a PC-based profit-plan model that appeals to both marketers and analysts.

PHOTOGRAPHY BY JEFF RYCUS/BLACK STAR

managers used to delegate profit analysis to the financial analysts. Now, many of them save time and improve everyone's productivity by doing the analysis themselves.

A Search for Speed and Comfort

Getting to this point was a long process. The financial models that NCR had developed over the years ran initially on mainframes and were used by the company's financial analysts. Then, in 1984, the Corporate Finance Division produced a spreadsheet version, known as the *Profit Model*, to run on PCs.

For the first time, it was possible to do quick turnarounds using what-if scenarios. An analyst could see immediately, for example, the expected effect on profitability of a change in pricing policy.

Like most spreadsheet templates of that era, however, NCR's model made no concession to user friendliness. It was not the sort of tool that attracted a marketing manager.

In the late 1980s, the Corporate Marketing and Strategic Planning Division began to look for an alternative that would provide direct, and much more comprehensive, support—not just to financial analysts but to product and marketing managers as well. A spreadsheet approach was a logical contender, especially since NCR's financial analysts were by now firmly wedded to spreadsheets for profit analysis and many other tasks. Indeed, NCR's developers considered, but ultimately rejected, a spreadsheet approach. The new program features that were desired made the task too large and complex for a spreadsheet of that era to handle.

Instead, in 1987 the developers came up with a financial model written in a fourth-generation language and database-management system called *Progress*, from Progress Software Corp. This model, called *PFM*, for *Program Financial Model*, ran on both PCs and minicomputers. An analyst could enter 10 years of data on a single, standard input screen. *PFM* would then crank out a comprehensive financial analysis for that period.

PFM offered a better user interface than its predecessors, which made data input easier. It also generated more complete reports than the *Profit Model*. But it was slow. If an analyst decided to tweak a variable, he had a long wait for the result.

Maxwell: With the old program, 'you put numbers in, you got numbers out. But that's not what we wanted.'

With as many as 44 variables, it was hard for an executive to take the time to analyze all the possibilities in a new-product venture.

Despite its limitations, the program had, and still has, its users. But the reaction to *PFM* pointed to a major problem in designing a program for two disparate groups of users. The marketers were unenthusiastic about *PFM*'s intimidating, fill-in-the-blanks approach. The financial analysts would have preferred rows and columns and the freedom to alter numbers at will.

Furthermore, it was not easy to improve the program. The *Progress* code was much easier to modify than the code used in the earlier models. But the many complex formulas were hard-coded, and careful testing was required after each revision. This meant that major revisions often required months of work.

One of *PFM*'s developers, who spent nine months working on the first and second releases of *PFM*, offers a perspective. The model did what it was supposed to do, says Stephen Kemp, now a manager of pricing and financial services in NCR's U.S. Group. "But it never really won over its two user bases."

A New Approach

Among those never won over was William Hahn, director of program financial management in NCR's Corporate Marketing and Strategic Planning Division. He is an experienced spreadsheet user, and he says, "I continued to believe that we could and should use spreadsheets." When John Maxwell, a PC enthusiast, assumed responsibility for *PFM* from Kemp, he quickly reached the same conclusion.

Maxwell, a pricing analyst in the Corporate Marketing and Strategic Planning Division, was particularly concerned about *PFM*'s formality, which made it something of a black box to a user. "You put numbers in, you got numbers out. But that's not what we wanted," says Maxwell, who has an MBA from Michigan State University.

It was too easy, Maxwell says, to look at *PFM*'s output and see a loser. He felt that managers needed a program that would allow them to explore alternatives more easily. Instead of giving up on a product venture, he says, "find out how to make it a winner."

Hahn and Maxwell set out late last year to find a spreadsheet solution. They started by studying the spreadsheet packages on the market. Besides *1-2-3*, they considered Informix Software's *The Smart Spreadsheet*, Microsoft Corp.'s *Excel*, and Computer Associates International's *SuperCalc5*. All seemed capable of doing the job. But Maxwell quickly zeroed in on *SuperCalc* and *1-2-3* Release 3 because of their multipage capability. "3-D solved all kinds of problems for us," says Maxwell. "It let me segregate each marketing-channel analysis and report on a different page."

There were more *SuperCalc* users than *1-2-3* users at NCR, so *SuperCalc* had to be considered seriously. But in the end, after careful time trials and much discussion, Hahn and Maxwell settled on *1-2-3*. Around that time they learned about the availability of Add-In Toolkit, which lets you use a high-level, Pascal-like language to create add-ins for Release 3. "That was the icing on the cake," adds Hahn. "It let us do a lot of things we could not have done otherwise."

Doing It Twice

Maxwell and Hahn are neither systems analysts nor programmers, but they designed *Quick Planner* themselves. Then Maxwell developed the *1-2-3* spreadsheets, and a student intern from Ohio State University, Scott Stephens, did the Toolkit part of the task.

The add-in coded with Toolkit provided, among other things, a spiffy interface with pop-up windows. Aesthetics aside, the goal was ease of use and less costly user training and maintenance. "We wanted a tightly integrated, bullet-proof interface," says Maxwell. "Macros can't provide that." A macro expert might take issue with that statement. But unquestionably it would be tough to recreate *Quick Planner*'s interface with macros.

For the prototype, Hahn and Maxwell, in effect, recreated *PFM*. The model retrieved data for each marketing channel from the hard disk as needed, then saved the calculated results back to disk. Besides providing the user interface, the custom add-in did most of the extensive data transfer. *1-2-3* did the number crunching. The result was a model that was faster, easier to use, and easier to maintain than *PFM*. Since *1-2-3* is a lot smaller than *Progress*, the new spreadsheet approach also required less disk capacity.

Nonetheless, all that data exchange made the program a bit slow. It would be nice to get more data into *1-2-3*'s memory. But there was another idea in the air as well that would make such a move imperative. Eventually that idea would transform the way marketers and analysts work with *Quick Planner*.

The idea was an analytical tool that Hahn calls a scratch pad. He had developed the tool earlier to help teach financial analysis within the company. In his workshops, he taught managers how to use the scratch pad—then pencil, paper, and calculator—to list financial variables and see how changing them affects, say, return on assets. Later, Hahn put his scratch pad in a spreadsheet to speed the analysis.

Gardner: With the new program, 'we can spend more time working with the information.'

The scratch pad was working so well in the educational workshops that Hahn decided it had to be part of *Quick Planner*. That meant that the model would have to have access to a large set of the financial variables. And that meant that it would be necessary to get more of the data into memory. Hahn and Maxwell had to scrap the original spreadsheet and start over. Since disk access would no longer predominate, they also scrapped most of the Toolkit code—but not the part that provides the spiffy interface.

There were compromises ahead. For practical reasons, the two developers decided that the program must run on an NCR PC916, a '386 machine whose standard model contains 1.9 megabytes of RAM. However, the spreadsheets and code for the new model required more than 1.9 megabytes. So Hahn and Maxwell split the model into two parts: one worksheet for marketing analysis, the other for development and production analysis. They also had to cut the number of marketing channels from 10 to 8 and the number of years from 10 to 8, a change that no one considered important.

Even with the redesign, "the whole project took about four months," says Maxwell. That includes the several weeks that were required to evaluate the spreadsheet packages. For comparison, Maxwell notes that *PFM* and its two revisions were developed over a period of three years.

The Quick Planner

In its current version, *Quick Planner*, running on *1-2-3* Release 3 with the Toolkit-coded add-in, requires 1.9 megabytes of RAM, 5.5 megabytes of free disk space, and an EGA or VGA monitor. Some users run the program on a '286 machine, though Maxwell recommends a '386 for better response time.

According to Hahn, NCR analysts and marketers respond enthusiastically to a demo of *Quick Planner*. But many *SuperCalc* users dig in their heels when they realize that they need *1-2-3*. Their biggest fear, says Hahn drily, is that they'll have to learn another spreadsheet. "We have to do a lot of selling."

Some of the resistance would crumble, says Hahn, if *1-2-3*'s opening screen did not appear, however briefly. Then users would perceive *Quick Planner* as a stand-alone program. Hahn and Maxwell yearn for a run-time version of *1-2-3* or even a Release 3 compiler that works with

Toolkit-created add-ins. "Combining Toolkit and run-time *1-2-3*," says Maxwell, "would be awesome."

Even now, though, a user of *Quick Planner* does not see much of *1-2-3*. The model is loaded automatically from an AUTO123.WK3 file. From there, the program is menu driven.

Quick Planner starts with a small introductory menu that lets a user choose either the marketing or the financial model. Typically, a product manager selects the Marketing File Management menu, in which he or she can choose to create, edit, copy, or delete a marketing analysis. If the choice is to create an analysis, a marketing-channel definition screen appears. The manager can enter data on each defined channel (such as expected sales volume for direct sales in Europe) and, finally, generate a report on any combination of channels.

A financial analyst typically selects the D&P (development and production) File Management menu and gets a similar sequence of choices. This module can consolidate data from as many as five marketing analyses. The module's output is, in effect, the market demand that will drive production decisions. The analyst then uses the D&P module to join that demand scenario with information about production and development costs to generate a profit analysis for top management.

Both of the program modules include the scratch pad. If a manager types in a percentage goal for return on assets, a goal-seek window pops down over the scratch pad. Next to the key variables are the numbers that would be required to meet the return-on-assets goal.

Users like the goal-seek feature, says Maxwell. "They get excited about it because they can see the implications of every single change they make." Joe Gardner is one who believes that the immediacy of the results is important. "You can be thinking ahead," he says, "about where you need to go, and about what adjustments you need to make."

After working with the scratch pad, a user can view a multiyear screen to see what happens over a longer period. On this screen the user can adjust specific variables and watch the totals in the upper-left corner change instantly.

Some Problems, Too

Despite its success, *Quick Planner* is not without its shortcomings. Splitting the model into two parts makes some sense, since the two analyses are, for the most part, done by two different groups. However, about half of the company's two dozen development groups have to do both analyses. For them, the split means more file-combine operations and, as Maxwell puts it, a "clunky" way of doing some tasks.

Hahn: The Add-In Toolkit 'was the icing on the cake. It let us do things we couldn't do otherwise.'

Another shortcoming of the program, according to some users, is the inflexibility of its menu structure. "Right now it's almost like a maze of concrete," says Gardner. "You have to follow these paths in and out." He would rather jump from place to place, bypassing the menus.

Gardner would also like the model to do more to help him pull together the pieces of a product program. If a product program includes a computer, a printer, software, and a training course, for example, he has to write down the pieces and add up the prices before working with the model. A product-configuration screen, says Gardner, would save him "a lot of paperwork."

For some other users, printing reports has been a problem. Up to a point, the program "was wonderful," says Clare D'Onofrio, a financial specialist in the Workstation Products Division. "But we couldn't get it to print." After wrestling with *Quick Planner* for a while, she finally loaded her reports into another spreadsheet and juggled the numbers into printable form. That bug has slowed the acceptance of the model, at least for now.

Maxwell blames Lotus for the printing problem. "I don't want to have to coordinate the settings on the printer with the settings in *1-2-3*," he says. "I want *1-2-3* to tell my printer what to print."

Add-In Toolkit may yet provide a solution, Maxwell hopes. He has used Toolkit to design an add-in that allows a user to enter printer information on the screen and then adjust print parameters accordingly. This feature will soon be available to all users of the model.

A big plus for *Quick Planner* is that changes in the program are not all that hard to make. Maxwell once changed the program in the middle of a demo. Someone suggested that he add a calculation for production requirements to the top of a multiyear screen. "I did it right there," he says. "I got it up and running in five minutes."

And despite his wish list, Gardner is quick to defend *Quick Planner* as a valuable way to focus on return on assets, a key measure of productivity. "If the company continues to focus on productivity, then this really is the way to go," says Gardner. "It makes the productivity concept very easy to understand."

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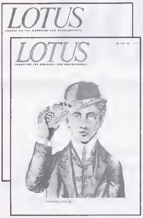

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TECHNIQUES

Macros Made

Enter your name in cell B1 of an empty worksheet. Next, enter '\n in cell A1. Now press slash and select Range Name Create (in *Symphony*, press MENU and select Range Name Create), and enter \n. Specify cell B1 as the range to name. Guess what? You just wrote a macro.

The fundamentals of writing a macro are easy to describe and learn. Consider that it took only one paragraph to describe the creation of a simple macro. In a few minutes, you could use this macro and then write several more that reveal how these worksheet tools save time and make work easier.

Think of a macro as a set of instructions that tell someone else how to accomplish a task. The someone else is the *1-2-3* or *Symphony* macro processor.

At its simplest, a macro is a recording of the keystrokes that complete a task. No matter how complex the task, you replay the recording by pressing only two keys. The macro processor then follows the recorded instructions and completes the task for you.

Macro creation requires only two steps: Record macro instructions as labels in your worksheet and then assign a range name that identifies the macro.

The macro at the beginning of this

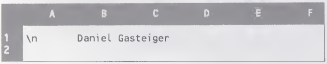
PHOTOGRAPHY BY TONY SCARPETTA HAIR AND MAKEUP BY LESLEY FENTON MODEL REBECCA LYNN FIELDING

Easy

BY DANIEL GASTEIGER

Even a child can build tools that speed through work.

article contains the keystrokes that type your name. With this macro in a worksheet, you can instruct the macro processor to type your name wherever you want it to appear. My name-typing macro appears in the following figure:



```
    A        B           C       D       E       F
1   \n       Daniel Gasteiger
2
```

The label in cell A1 isn't part of the macro. It serves as a reminder of the macro's name. To see your macro work, move the cell pointer to cell D5, hold down the MACRO key (Alt on most computers), and press N. Your name instantly appears on the edit line of the control panel. To enter your name in the current cell, press Return.

Try the macro again. Move the cell pointer to cell D6 and press MACRO-N. Once again, your name appears in the control panel. Press Return to enter it in the cell.

AUTOMATIC TYPING

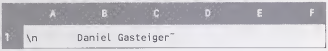
Many people think of macros as automatic typing. Indeed, the macro processor can activate almost any key that you can press. For example, a macro can type numbers and letters, move the cell pointer, make a menu selection, and invoke a function key.

The macro that you created simply types letters. But many of the keys that you press while in a worksheet don't have simple, one-character names. What single character would you use to represent the Return key, the EDIT key, or the Home key?

Fortunately, most nonalphanumeric keys in *1-2-3* and *Symphony* have a corresponding macro key name that the macro processor recognizes to mean "press the named key." A key name typically consists of a word surrounded by braces. For example, the key name for the RightArrow key is {RIGHT}. The key name for the Escape key is {ESCAPE}. The table on page 41 lists the nonalphanumeric keys and their corresponding macro key names.

So far, your name macro puts information into the control panel only. To enter the information into the worksheet, you must press the Return key. If you insert the key word for Return, which is the tilde (~), into the name macro, then the macro will be able to enter your name in the current cell.

Move the cell pointer to cell B1 and press the EDIT key (F2 on most computers). Then type a tilde and press Return. The edited macro appears below:



```
    A        B           C       D       E       F
1   \n       Daniel Gasteiger~
```

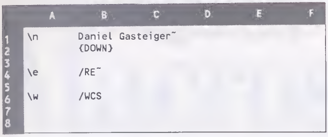
Move the cell pointer to cell D7. Then press MACRO-N to run the macro. Your name appears in the cell.

Let's make the macro do a little more work. Enter the macro key word {DOWN} in cell B2. This command moves the cell pointer down one row after the macro processor enters your name in the current cell. Try it. Move the pointer to cell D8 and press MACRO-N several times. Each time you press that key combination, your name appears in the current cell and then the cell pointer moves down one row.

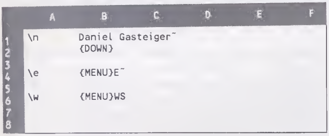
This exercise reveals an important principle of macro processing. The macro processor reads macro commands from left to right across a cell. When the processor reads the last command in a cell, it looks to the next cell down the column for additional commands. If the next cell is blank or if it contains a numeric value, the macro stops. If the next cell contains a label, the macro processor interprets the label as macro commands.

A FEW SIMPLE MACROS

Create the two new macros shown in range A4..B6 of the figures on the next page. The first figure shows macros for *1-2-3*, the second shows the *Symphony* macros.



```
     A         B             C        D        E        F
1  \n        Daniel Gasteiger~
2            {DOWN}
3
4  \e        /RE~
5
6  \w        /WCS
7
8
```



```
     A         B             C        D        E        F
1  \n        Daniel Gasteiger~
2            {DOWN}
3
4  \e        {MENU}E~
5
6  \w        {MENU}WS
7
8
```

Be sure to precede each label in range A4..B6 with an apostrophe label prefix. Without one, the entries in cells A4 and A6 will appear as repeating labels. And without the label prefix, you won't be able to type the entries for cells B4 and B6. This is because pressing the slash key will bring up the menu unless you precede the slash with a label prefix.

After entering the new macros, assign names to them. But this time, rather than use the Range Name Create command, use the Range Name Labels Right command: Press slash (in *Symphony*, MENU), select Range Name Labels Right, and specify range A4..A6. This command assigns the labels in the designated range as names for the cells to the immediate right. Hence, the command assigns the name \e to cell B4 and \w to cell B6.

By now you might have noticed that each macro name consists of a backslash (\\) followed by a single letter. To run any macro named with a backslash-letter combination, hold down the MACRO key and press the letter of the macro's name. In the worksheet that contains your name macro, move the cell pointer to cell D5, the first cell into which the macro \n entered your name, and press MACRO-E. Your name vanishes from the cell. What happened? The macro processor followed the instructions stored in the cell named \e, which is cell B4. (Warning: Don't use this or any macro when the cell pointer is in one of the cells that contain macro code! You might destroy part of the macro by doing so.)

Whether you use *1-2-3* or *Symphony*, the results produced by this macro are the same. In *1-2-3* the instructions are /RE~. They mean "press the slash key to access the menu, type *R* to select Range, type *E* to select Erase, and press Return to accept the current cell as the range to erase." The *Symphony* macro instructions are {MENU}E~. They mean "press the MENU key, type *E* to select Erase, and press Return to accept the current cell as the range to erase." In *1-2-3* the macro saves two keystrokes each time you erase a cell. In *Symphony* the technique saves only one keystroke per erased cell. To test this again, move the cell pointer to cell D6 and then press MACRO-E to erase the entry from that cell.

If you press each key represented by the commands in cell B6, the macro named \w, you'll see that the macro selects the menu choices necessary to set a column width. The *1-2-3* macro selects /Worksheet Column Set-Width; the *Symphony* macro selects MENU Width Set.

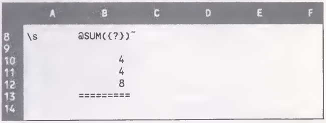
Try the macro. With the cell pointer in column D, press MACRO-W. A prompt that indicates the current column width appears in the control panel. Press the RightArrow key several times until the column is wide enough to accommodate your name. Or if your name doesn't already fill the column, press the LeftArrow key to decrease the column width and then press Return.

BUT WAIT, THERE'S MORE

So far we've talked about macros that replace your efforts at the keyboard. While such automatic-typing macros can significantly accelerate your work, they demonstrate only a small part of the software's macro capabilities. The macro processor recognizes a large collection of special commands that provide more power than the menus and function keys alone. In *1-2-3* these commands are the Advanced Macro Commands; in *Symphony*, they are the *Symphony* Command Language. Here we'll refer to them as the Advanced Macro Commands.

The Advanced Macro Commands provide a substantial programming language that approaches the power of such languages as BASIC. But that doesn't mean that you need to be a computer programmer to use these commands. In fact, most of them perform processes that fit very well into your keyboard macros.

For example, when the macro processor is working though a menu sequence or building a formula, you may want the macro to pause for your input. The following figure contains a macro that does just that:



```
     A         B             C        D        E        F
8  \s        @SUM({?})~
9
10               4
11               4
12               8
13           =========
14
```

Here's the recipe: Enter the labels in cells A8 and B8.

NONALPHANUMERIC KEYS AND CORRESPONDING MACRO KEY NAMES

Each key name in each table works for all the products listed at the top of the table. If a particular key name works in only a certain release or product, that information is indicated in parentheses.

1-2-3 Releases 2.01, 2.2, and 3 and *Symphony* Releases 2.0 and 2.2

KEY	MACRO KEY NAME
ABS	{ABS}
Backspace	{BACKSPACE} or {BS}
Big Left	{BIGLEFT}
Big Right	{BIGRIGHT}
CALC	{CALC}
Delete	{DELETE} (or {DEL} in *1-2-3*)
DownArrow	{DOWN} (or {D} in *1-2-3*)
EDIT	{EDIT}
End	{END}
Escape	{ESCAPE} or {ESC}
GOTO	{GOTO}
Home	{HOME}
Insert	{INSERT} (or {INS} in *1-2-3*)
LeftArrow	{LEFT} (or {L} in *1-2-3*)
PageDown	{PGDN} (or {BIGDOWN} in *Symphony*)
PageUp	{PGUP} (or {BIGUP} in *Symphony*)
Return	~
RightArrow	{RIGHT} (or {R} in *1-2-3*)
UpArrow	{UP} (or {U} in *1-2-3*)
WINDOW	{WINDOW}

Additional Keys: *Symphony* Releases 2.0 and 2.2

KEY	MACRO KEY NAME
CENTER	{CENTER}
Ctrl-Backspace	{DWORD}
Ctrl-Break	{BREAK}
Ctrl-C	{COPY}
Ctrl-D	{DLINE}
Ctrl-F	{FORMAT}
Ctrl-J	{AUTO}
Ctrl-M	{MOVE}
Ctrl-N	{PAGE}
Ctrl-P	{PASTE}
Ctrl-PgDn	{NEXTPAGE}
Ctrl-PgUp	{TOPPAGE}
Ctrl-R	{REPLACE}
Ctrl-S	{SEARCH}
Ctrl-T	{DLEFT}
Ctrl-X	{CASE}
Ctrl-Y	{DRIGHT}
DRAW	{DRAW}
ERASE	{ERASE}
HELP	{HELP}
INDENT	{INDENT}
JUSTIFY	{JUSTIFY}
SERVICES	{SERVICES} or {S}
SPLIT	{SPLIT}
SWITCH	{SWITCH}
Tab key	{TAB}
TYPE	{TYPE}
WHERE	{WHERE}
ZOOM	{ZOOM}

Additional Keys: *1-2-3* Releases 2.2 and 3

KEY	MACRO KEY NAME
ADDIN	{ADDIN} or {APP4}
APP1	{APP1}
APP2	{APP2}
APP3	{APP3}
FILE	{FILE} (Release 3 only)
FIRST CELL	{FIRSTCELL} or {FC} (Release 3 only)
FIRST FILE	{FIRSTFILE}, {FF}, or {FILE}{HOME} (Release 3 only)
HELP	{HELP}
LAST CELL	{LASTCELL} or {LC}
LAST FILE	{LASTFILE}, {LF}, or {FILE}{END} (Release 3 only)
MENU	the slash key (/)
NEXT FILE	{NEXTFILE}, {NF}, or {FILE}{NS} (Release 3 only)
NEXT SHEET	{NEXTSHEET} or {NS} (Release 3 only)
No corresponding key*	{CLEARENTRY} or {CE} (Release 3 only)
PREV FILE	{PREVFILE}, {PF}, or {FILE}{PS} (Release 3 only)
PREV SHEET	{PREVSHEET} or {PS} (Release 3 only)
ZOOM	{ZOOM} (Release 3 only)

*Clears data from edit line when Release 3 is in Edit mode

Additional Keys: All Releases of *1-2-3*

KEY	MACRO KEY NAME
GRAPH	{GRAPH}
NAME	{NAME}
QUERY	{QUERY}
TABLE	{TABLE}

Be sure to precede each with an apostrophe. Next, press slash (in *Symphony*, MENU), select Range Name Labels Right, and specify cell A8. Enter the values shown in range B10..B12, and to create the double-dashed line, enter a backslash and an equal sign (\=) in cell B13. Move the cell pointer to cell B14 and press MACRO-S to start the macro.

> The Advanced Macro Commands provide a substantial programming language.
>
> ▲▲▲

The macro processor types the characters *@SUM(* and then pauses at the {?} command. During the pause, you can specify the range that the @SUM function will total. In this case, press the UpArrow key four times, press the period key (in *Symphony*, press the Tab key), and press the DownArrow key twice. This highlights range B10..B12, the range you wish to sum. Press Return to instruct the macro processor to process the instructions that follow the {?} command. The macro types a close parenthesis and presses Return to enter the @SUM formula in the current cell.

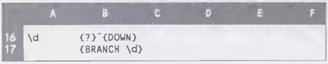
The {?} command is one of the Advanced Macro Commands. To the macro processor, it means "pause and accept any instructions from the keyboard until someone presses Return." During the pause, you can type characters, make menu selections, move the cell pointer, and use the function keys. The moment you press Return, the macro processor resumes control of the spreadsheet.

As this example demonstrates, pressing Return doesn't enter the @SUM formula in the worksheet. Rather, when you press Return, the macro finishes typing the @SUM formula and then processes a tilde, which is the macro key name for the Return key.

ADVANCED COMMAND EASES DATA ENTRY

The macro processor typically reads instructions cell by cell, down a column. However, you may want the processor to read some commands down the column, jump to a cell not in sequence, and continue reading commands in that cell. This is often the case when a macro needs to keep repeating a set of commands. The {BRANCH} command lets your macro do just that.

The following figure shows a handy data-entry macro:



```
        A         B             C         D         E         F
16   \d        {?}~{DOWN}
17             {BRANCH \d}
```

Enter the macro code and use the Range Name Labels Right command to name it. Now move the cell pointer to cell B19 and press MACRO-D. The CMD indicator appears at the bottom of the screen, indicating that a macro command is being executed. Nothing seems to happen because the first command, which is {?}, causes the macro processor to pause. During the pause, type an entry for the current cell—for example, type the number *9*—and press Return. The macro enters what you type and moves the cell pointer down one row.

Next, the macro processor encounters the command {BRANCH \d}, which means "look for more commands to process in the cell named *\d*." At that point, macro control passes back to the cell named *\d*, which is cell B16, and the macro restarts. This is an infinite-loop macro—in other words, it's a macro that repeats itself indefinitely until you intervene.

When you type an entry for the new cell and press Return, the macro processor stores your entry and moves the cell pointer down. After entering data in a particular column, use the Arrow keys to move the cell pointer to the next location for data entry. When you finish entering data, stop the macro by holding down the Control key and pressing Break. To clear the resulting error, press Escape or Return.

With some IBM PC-compatible computers, when you press Control-Break, the macro doesn't stop. This indicates that there is a minor incompatibility between the way your computer and an IBM PC operate with respect to the Control-Break command. If the macro doesn't stop when you press Control-Break, move the cell pointer to cell B17 and overwrite the {BRANCH} command by entering a number in place of it.

ON YOUR OWN

The {?} and {BRANCH} commands are two examples of the more than 40 Advanced Macro Commands. These commands perform such tasks as altering a macro's flow of control, which is also known as branching; displaying custom prompts and menus; placing data in cells; altering various aspects of the worksheet display; and moving data from the worksheet to disk and back.

You may never use all of these commands, but as you become familiar with them, you'll see more and more opportunities to put them to work in your macros. To learn more about macros, take a look at some of the 1-2-3 and Symphony Macros columns, which occasionally deal with macro topics for beginners. And watch for an upcoming article that will explore the Advanced Macro Commands in more detail. **L**

Daniel Gasteiger is a *1-2-3* and *Symphony* consultant in Boston and a contributing editor to *LOTUS.*

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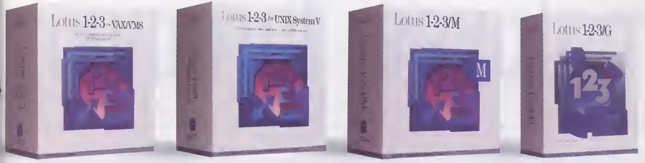

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APPLICATIONS

Getting a Grip on Employee Turnover

Five indicators help you pinpoint the sources of work force instability. BY CARL SANDERS

Employee turnover is something that executives frequently complain about but can seldom change. The inability to reduce employee turnover is partly due to a lack of information about turnover rates. Close examination of the work force trends within an organization can be the first step toward improved financial performance.

Typically, about 13% of a company's employees leave per year, though the figures vary by industry (see chart on next page). Excessive turnover creates a shortage of employees, a decline in customer service, and therefore a loss in profits. Furthermore, the costs of recruiting, hiring, and training new employees can be significant. This expense shows up on a company's income statement, but what doesn't show up is the lost experience and the resulting decline in morale and productivity.

You can use *1-2-3* Releases 2.01 and higher or *Symphony* Releases 2.0 and 2.2 to quantify employee turnover. The following model calculates five different indicators, each measuring a different aspect of the problem. Once you know how to interpret these variables, you can begin to manage employee turnover.

Personnel records provide the data needed for the turnover analysis. The name, start date, and leave date (if any) of each person employed during the study period are needed for the model. Each employee must also be identified as a stayer (one who is still employed at the end of the study period) or a leaver (one who leaves during the study period). Typically, a study period is a calendar year or a budget year.

Will They Stay or Will They Go?

The most commonly used indicator of employee turnover is the crude turnover rate. This rate measures the general turnover in a company's work force by dividing the number of leavers by the average number of persons employed during the study period:

$$\frac{\text{leavers}}{\text{(empls. at begin date + empls. at end date)/2}}$$

Two other indicators measure the turnover rate for specific segments of the work force. The instability rate focuses on those leavers who started working for the company before the study began:

$$\frac{\text{leavers employed at begin date}}{\text{employees at begin date}}$$

The turnover for new hires—the people hired during the study period—is measured by the wastage rate:

$$\frac{\text{new hires who are leavers}}{\text{new hires}}$$

The final two indicators measure the experience of leavers and stayers. Mean service of leavers indicates the average length of employment (in months) of those who leave:

$$\frac{\text{total months employed for all leavers}}{\text{leavers}}$$

Mean service of stayers indicates the average length of employment of those who stay:

$$\frac{\text{total months employed for all stayers}}{\text{stayers}}$$

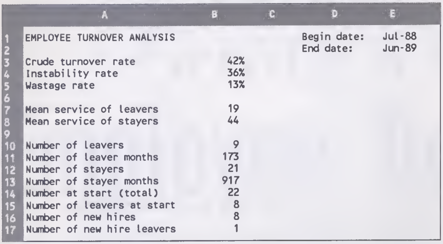
How the Model Works

Our example analyzes the turnover of surgical nurses at Scalpel Hospital. Because of a nursing shortage, effective management of this staff is critical. To build the model, follow the instructions in the box on page 50.

Formulas in range B3..B8 of figure 1 compute the five indicators discussed above. To compute the counts and sums needed for these formulas, the worksheet uses database @functions in range B10..B17. The syntax of these functions is @DSUM(*database,offset,criterion*) and @DCOUNT(*database,offset,criterion*). The @DSUM formulas add the entries in the offset column of the database that match the specified criterion. The @DCOUNT formulas work the same way, but they count matching entries rather than add them.

These @D formulas use the employee records in the range named *input* (range A23..E130) as their database argument. The labels in row 23 (figure 2) are field names, and each of the succeeding rows contains a record for one nurse. The first field in each record (column A) contains the nurse's last name. The second field (column B) contains the nurse's current status code: *S* for stayer and *L* for leaver. The third field (column C) contains the nurse's start date, and the fourth field (column D) contains the nurse's leave date, if applicable.

The fifth and final field of *input* (column E) contains formulas that calculate the length of employment in months for each nurse. An @IF function in each formula checks the nurse's status in column B. If the nurse is a leaver, the formula computes the months of employment using the nurse's start and leave dates. If the nurse is a stayer, the formula computes the months of employment



```
              A                        B       C        D           E
 1  EMPLOYEE TURNOVER ANALYSIS                     Begin date:   Jul-88
 2                                                 End date:     Jun-89
 3  Crude turnover rate               42%
 4  Instability rate                  36%
 5  Wastage rate                      13%
 6
 7  Mean service of leavers            19
 8  Mean service of stayers            44
 9
10  Number of leavers                   9
11  Number of leaver months           173
12  Number of stayers                  21
13  Number of stayer months           917
14  Number at start (total)            22
15  Number of leavers at start          8
16  Number of new hires                 8
17  Number of new hire leavers          1
```

FIGURE 1. The formulas in range B3. B8 yield basic estimates of employee turnover for the period July 1988 to June 1989 (range E1 .E2).

using the nurse's start date and the study's end date.

Range G1..H17 (figure 3) contains the six criterion ranges used by the @D formulas in range B10..B17. Each criterion range has two rows. The first row contains field names that match field names in *input*. The second row contains selection criteria.

To see how a criterion range works, let's look at three of the six shown in figure 3. In the first criterion range (range G1..H2), the stay/leave criterion in cell G2 is *L*, which means "select only the records of leavers," and the start criterion in cell H2 is blank, which means "select all records." Therefore, the @D formulas that use this criterion range will select the records of leavers regardless of their start date.

Now look at the third criterion range (range G7..H8). The criteria in range G8..H8 are a blank cell and the formula +START<$BDATE. Since cell G8 is blank, this criterion range will disregard a nurse's stayer/leaver status, since a blank cell selects all records. However, the entry in cell H8 specifies that only nurses who started before the study's begin date will be selected. Because the first record in the database meets this criterion, the formula in cell H8 displays a 1 (true). The @DCOUNT formula that uses this criterion range (in cell B14) determines if each record is true or false for this criterion. Therefore, this criterion range will select the records of nurses who started before the begin date regardless of their current status.

Finally, look at the fourth criterion range (range G10..H11). Cell G11 contains the label *L*, and cell H11 contains the criterion formula +START<$BDATE. This criterion range will find the records of leavers who started before the begin date, in this case, July 1988.

The @D formulas in range B10..B17 use the six criterion ranges to compute different variables. The @DCOUNT formulas count the records that meet a criterion. For example, the formula in cell B10 is @DCOUNT(input,0,crit1). This formula uses the criteria specified in the range named *crit1* (range G1..H2). It counts the number of leavers in the database regardless of their start date.

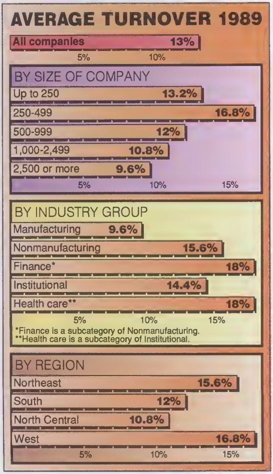
The @DSUM formula in cell B11 works similarly. It also uses the criterion range *crit1*, selecting leavers regardless of their start date. But instead of counting the number of leavers, the formula sums the number of months they worked. These values can be found four columns to the right of the first column of the database, in column E.

The formulas in range B10..B17 provide the counts and sums for the turnover formulas in ranges B3..B5 and B7..B8. Each cell in range B10..B17 has a range name, so if the analysis template in figure 1 is entered in a different part of the worksheet, the turnover formulas will still work. The last four turnover formulas use @IF functions to check for division by zero and return @NA if that condition exists. Otherwise, they return values.

Interpreting the Indicators

Now we'll examine the turnover rates shown in figure 1 for Scalpel Hospital's surgical nurses. The crude turnover rate indicates that 42% of the average number of nurses left during the study period. This raw number provides a convenient point of comparison with other study periods or with other surgical nursing staffs in the area.

But the crude turnover rate doesn't measure the stability of the staff. Are a



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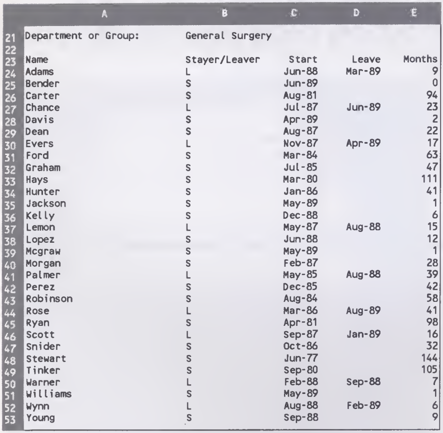
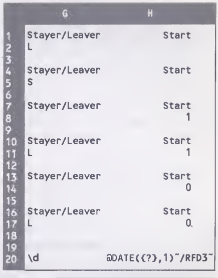


	A	B	C	D	E
21	Department or Group:	General Surgery			
22					
23	Name	Stayer/Leaver	Start	Leave	Months
24	Adams	L	Jun-88	Mar-89	9
25	Bender	S	Jun-89		0
26	Carter	S	Aug-81		94
27	Chance	L	Jul-87	Jun-89	23
28	Davis	S	Apr-89		2
29	Dean	S	Aug-87		22
30	Evers	L	Nov-87	Apr-89	17
31	Ford	S	Mar-84		63
32	Graham	S	Jul-85		47
33	Hays	S	Mar-80		111
34	Hunter	S	Jan-86		41
35	Jackson	S	May-89		1
36	Kelly	S	Dec-88		6
37	Lemon	L	May-87	Aug-88	15
38	Lopez	S	Jun-88		12
39	Mcgraw	S	May-89		1
40	Morgan	S	Feb-87		28
41	Palmer	L	May-85	Aug-88	39
42	Perez	S	Dec-85		42
43	Robinson	S	Aug-84		58
44	Rose	L	Mar-86	Aug-89	41
45	Ryan	S	Apr-81		98
46	Scott	L	Sep-87	Jan-89	16
47	Snider	S	Oct-86		32
48	Stewart	S	Jun-77		144
49	Tinker	S	Sep-80		105
50	Warner	L	Feb-88	Sep-88	7
51	Williams	S	May-89		1
52	Wynn	L	Aug-88	Feb-89	6
53	Young	S	Sep-88		9

FIGURE 2. Turnover rates are calculated from employee records. Each record in the database contains an employee's name, status, start date, and leave date (if any). The formulas in column E calculate the number of months the employee has worked.



	G	H
1	Stayer/Leaver	Start
2	L	
3		
4	Stayer/Leaver	Start
5	S	
6		
7	Stayer/Leaver	Start
8		1
9		
10	Stayer/Leaver	Start
11	L	1
12		
13	Stayer/Leaver	Start
14		0
15		
16	Stayer/Leaver	Start
17	L	0
18		
19		
20	\d	@DATE({?},1)~/RFD3~

FIGURE 3. Range G1..H17 contains six criterion ranges used by the @DCOUNT and @DSUM formulas in range B10..B17 of figure 1. The macro in cell H20 helps you enter dates

few positions turning over more than once, or are many positions turning over once? The instability rate provides the answer. Since the instability rate of 36% is almost as high as the crude turnover rate, we can conclude that many of the positions filled at the begin date turned over once. An instability rate that is low compared with the crude turnover rate indicates that a few positions turned over more than once.

The wastage rate shows that 13% of the new hires left. A high wastage rate—say, 30% or higher—might indicate poor hiring or inadequate orientation. But this indicator, like the crude turnover rate, varies greatly by industry.

By comparing the mean service of stayers with the mean service of leavers, we can tell which nurses the surgical area lost—the more experienced or the less experienced. The mean service of leavers was 19 months, and the mean service of stayers was 44 months. Therefore, we can conclude that the more experienced nurses did not leave.

Information obtained from interviews with the nurses who left could explain why they left. Perhaps the less experienced nurses leave because of limited opportunities for advancement. Supplementing the results of the turnover analysis with these interviews yields more-effective solutions.

We can gain further insight by comparing turnover rates across groups and over time. For example, by comparing turnover rates among different nursing areas at Scalpel Hospital, we can see which areas have the worst turnover problem. By examining the turnover rates within general surgery for several years, we can discover trends in turnover rates. A worksheet is a useful tool for such analyses.

The size of the group can affect the interpretation of the turnover rates. When the number of leavers is small, the mean service of leavers is a less reliable measure. Similarly, when the number of new hires is small, the wastage rate is less reliable. For reliable results, the database should include at least eight leavers and eight new hires.

How to Modify the Model

To use the model for your company or organization, first enter the begin and end dates of the study period in cells E1 and E2. The macro in cell H20 simplifies the task of entering dates. Position the cell pointer where you want the date to appear, hold down the MACRO key (Alt on most computers), and press D. The characters *@DATE(* appear on the status line, and the system waits for input from the keyboard. Type the year number, a comma, the month number, and press Return. The macro types *1* for the day, types a closing parenthesis, enters the completed date formula in the cell, and assigns it the Date 3 format.

After you enter the begin and end dates, replace the entry in cell B21 with the name of your company, organization, or department. Erase the sample database records in range A24..D53. Then enter your employee records, or import them from another file. If you're entering the dates manually, use the macro described above. Finally, copy the formula in cell E24 down the column for each employee record in your database.

If your database has many records, you can save data-entry time by using a formula to determine whether an employee is a stayer or a leaver. When employee names and dates are in the database, enter the following formula in cell B24:

```
@IF(D24<=$EDATE#AND#
  D24< >0,"L","S")
```

Copy this formula down the column for all the records in the database. Then select /Range Value (in *Symphony*, MENU Range Values) and indicate all formulas in column B as the From range and cell B24 as the To range. This command converts the formulas in column B to labels that can be used as criteria in the template's @DSUM formulas.

If you have more than 107 employees, you must use the Range Name Create command to enlarge *input*, which serves as the database argument in the @D formulas. Currently, *input* covers range A23..E130, or 107 records. When you add a new record at the end of the database, you must enlarge *input* manually with the Range Name Create command. But when you add a new record by placing the cell pointer within *input* and using the Worksheet Insert Row (in *Symphony*, MENU Insert Rows) command, *input* is enlarged automatically.

Carl Sanders is a facility manager at Vanderbilt University's School of Medicine.

HOW TO SET UP THE EMPLOYEE-TURNOVER-ANALYSIS WORKSHEET

1. Releases

This model works in *1-2-3* Releases 2.01 and higher and in *Symphony* Releases 2.0 and 2.2.

2. Global default

Column width: 10

Select /Worksheet Global Column-Width and enter *10* (*Symph:* select MENU Settings Width, enter *10*, and select Quit).

3. Individual column widths

Column	***Width***
A	28
B	14
D	11
F	9
G	14
H	16

For example, to set the width of column A, position the cell pointer in column A, select /Worksheet Column Set-Width (*Symph:*, MENU Width Set), and enter *28*.

4. Cell formats

Format	***Range***
Percent 0 (*Symph* % 0)	B3..B5
Fixed 0	B7..B8

For example, to set the format of range B3..B5, select /Range Format Percent, enter *0*, and indicate range B3..B5 (*Symph:* MENU, select Format %, enter *0*, and indicate range B3..B5).

5. Labels

Enter all labels shown in figures 1 through 3. Do not enter the dates in figures 1 and 2. Preface the entries in range G20..H20 with an apostrophe.

In *Symphony* enter the following label in cell H20:

```
@DATE({?},1)~{MENU}FD3~
```

Right-align the labels in ranges C23..E23 and H1..H16. For example, to right-align the labels in range C23..E23, select /Range Label Right (*Symph:* MENU Range Label-Alignment Right), and indicate range C23..E23.

6. Range names

Name	***Range***
count1	B10
count2	B12
count3	B14
count4	B15
count5	B16
count6	B17
sum1	B11
sum2	B13
bdate	E1
edate	E2
input	A23..E130
start	C24
crit1	G1..H2
crit2	G4..H5
crit3	G7..H8
crit4	G10..H11
crit5	G13..H14
crit6	G16..H17
\d	H20

For example, to assign the name *count1*, press slash (*Symph:* MENU), select Range Name Create, enter the name *count1*, and indicate cell B10.

7. Enter values

Use the date macro to enter the dates shown in figures 1 and 2. Enter only the month and year shown in the figures. For example, to enter the date in cell E1, place the cell pointer in cell E1, hold down the MACRO key (Alt on most computers), and press D. Then type *88,7* and press Return. The macro automatically adds 1 for the day argument and assigns the cell the Date 3 format.

8. Enter and copy formulas

Enter and copy the following formulas. Initially, the results of some of the formulas will not match the results in the figures.

Cell	***Formula***
B3	(count1/((count2+count3)/2))
B4	@IF(count3>0,count4/count3,@NA)
B5	@IF(count5>0,count6/count5,@NA)
B7	@IF(count1>0,sum1/count1,@NA)
B8	@IF(count2>0,sum2/count2,@NA)
B10	@DCOUNT(input,0,crit1)
B11	@DSUM(input,4,crit1)
B12	@DCOUNT(input,0,crit2)
B13	@DSUM(input,4,crit2)
B14	@DCOUNT(input,0,crit3)
B15	@DCOUNT(input,0,crit4)
B16	@DCOUNT(input,0,crit5)
B17	@DCOUNT(input,0,crit6)
E24	@ROUND((@IF(@UPPER(B24)="L",D24,$edate)–start)/30.44,0)

Copy cell E24 to range E25..E53

H8	+start<$bdate
H11	+start<$bdate
H14	+start>=$bdate
H17	+start>=$bdate

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CIRCLE 109 ON READER SERVICE CARD

Something Old, New, and Borrowed: SYMPHONY 2.2

Lotus's integrated software inherits several key features from the *other* Release 2.2 and boasts some powerful new features of its own.

BY BOB QUINN AND DONALD QUINN

With each new release, *Symphony* and *1-2-3* borrow more features from each other. *1-2-3* Release 2.2 incorporated many of *Symphony*'s distinctive capabilities, and it recently returned the favor by sharing most of its key features with *Symphony* Release 2.2: file linking, spreadsheet publishing with the *Allways* add-in, enhanced macro debugging, and new display options.

But *Symphony* Release 2.2 is more than a copycat. It lets you edit cells from within *Allways*, a feature not yet supported by other versions of the add-in, including the one supplied in *Symphony* Release 2.0 Plus. It also includes a customized version of Personics Corp.'s *@Base* add-in, which gives you direct access to disk-based databases and offers several new database-oriented @functions. An improved memory-management scheme makes better use of available RAM. And *Symphony* now even contains some of *Lotus Magellan*'s file-viewing functionality, which it uses in a powerful new way.

Raising the Ceiling

Symphony Release 2.2 offers far greater data capacity than previous versions. This is a significant enhancement because a *Symphony* application can take up a lot of RAM. A single file may contain multiple windows full of spreadsheets, databases, word-processing documents, and graphics, as well as the various settings sheets and range names that support the application. On top of that, each add-in you attach seizes a chunk of memory.

File linking lets you stretch your computer's memory by referencing cells that are stored in another file. You can create applications that consist of several files, only one of which need be—and can be—in memory at one time. Because *@Base* lets you work with disk-based databases, your database applications are no longer limited to available RAM. And thanks to a memory-management scheme called AEM (Advanced Expanded Memory), not only is it easier to conserve RAM, but there is more RAM to use.

Inside AEM

All versions of *Symphony* since Release 1.1 can use expanded memory. Until *Symphony* Release 2.2, however, you couldn't actually use all the expanded memory

JAMIE HOGAN

that the software nominally supported.

When you use *Symphony*, or *1-2-3* Release 2.01 or 2.2, with expanded memory, certain types of information–such as the program code and most add-ins–must stay in conventional memory (the first 640K of RAM). Other data can go into expanded memory, which is memory beyond 640K that conforms to the Lotus/Intel/Microsoft Expanded Memory Specification (LIM-EMS). To keep track of each item in expanded memory, the software uses a four-byte pointer.

In the past, the pointers had to reside in conventional memory. This meant that you would run out of usable memory when there was still expanded memory available but not enough conventional memory to store the pointers.

With AEM, *Symphony* overcomes this limitation. When *Symphony* Release 2.2 runs out of conventional memory in which to store pointers, AEM puts the pointers in expanded memory.

Data on a Platter

With the *@Base* add-in, the ambitious *Symphony* developer can sidestep three of the main limitations of conventional *Symphony* databases: They must fit in RAM, they can't contain more than 8,191 records, and they're cumbersome to integrate with external databases, such as those created with *dBase III Plus*.

The main module of *@Base* is an add-in called BASE.APP. Once you attach it, an additional environment type called BASE becomes available. Like any environment type, *@Base* can be invoked from the menu that appears when you press the TYPE key (Alt-F10) or when you select SERVICES Window Settings Type.

A second add-in, BASEUTL.APP, adds some utility features to *@Base*. BASE.APP uses 86K of RAM, and BASEUTL.APP uses another 18K. If you're short on available RAM, you can run *@Base* without the utilities. If you use the utilities, make sure you load BASE.APP first.

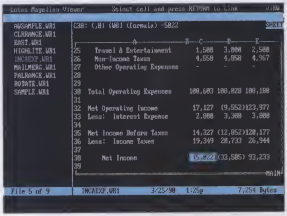
A third add-in, BASEFUNC.APP, which also uses 18K, gives you access to *@Base*'s @functions. You attach it before any other add-ins. And if you use expanded memory, you'll get optimal memory efficiency by attaching your desired add-ins before retrieving any files.

@Base Basics

@Base provides similar functionality to *1-2-3* Release 3's Data External commands. Like Release 3, *@Base* helps you integrate spreadsheet-oriented applications with *dBase* applications. But unlike Release 3, *Symphony* does not use Lotus's DataLens technology to interact with external files. Although the only database interface, or driver, that comes with Release 3 is for *dBase* files, DataLens enables Release 3 to support countless other data formats. All you need to do is load additional driver software. *@Base*, in contrast, supports only *dBase*-compatible DBF files. But if you need to create and access only DBF files, or if the external file format is unimportant to you, you may find *@Base* more capable than Release 3's DataLens-based Data External commands.

Symphony Release 2.2's version of *@Base* is tailored to resemble and work with other *Symphony* environments, but many of its features will be especially familiar to users of *dBase*. However, you can create and manage large disk-based databases with *@Base* even if you have never used *dBase*.

Like *dBase*, *@Base* lets you work with data in either of two modes: Browse or Form. Browse mode displays the data in a spreadsheet-like table. You can modify data via the EDIT key (F2) or by typing over the current contents, just as in SHEET mode. But unlike a spreadsheet, the Browse mode strictly controls cursor movement and the addition and deletion of records. You can browse through all fields or selected fields. *@Base*'s Form mode, much like *Symphony*'s FORM mode, displays data one record at a time. If all of the fields in a record don't fit on the screen, *@Base* will scroll through them as you move the cursor.



```
Lotus Magellan Viewer        Select cell and press RETURN to Link              VIEW

  AWSAMPLE.WR1   C38: (,0) (W8) (formula) -5022                               SHEET
  CLRRANGE.WR1
  EAST.WR1        ----------------A-----------------B--C--------D--------E----
  HIGHLITE.WR1   25     Travel & Entertainment        1,500    3,000    2,500
  INC&EXP.WR1    26     Non-Income Taxes              4,550    4,058    4,967
  MAILMERG.WR1   27     Other Operating Expenses         -        -        -
  PALRANGE.WR1   28
  ROTATE.WR1     29
  SAMPLE.WR1     30   Total Operating Expenses      100,603  100,028  100,100
                 31
                 32   Net Operating Income           17,127  (9,552)123,977
                 33   Less:  Interest Expense         2,800    3,300    3,800
                 34
                 35   Net Income Before Taxes        14,327 (12,852)120,177
                 36   Less:  Income Taxes            19,349   20,733   26,944
                 37
                 38       Net Income                 (5,022)(33,585)  93,233
                 39
                  ---------------------------------------------------------MAIN
 File 5 of 9      INC&EXP.WR1          3/25/90    1:25p            7,254 Bytes
```

An add-in based on *Magellan* viewer technology simplifies file linking in *Symphony*

@Base, like *dBase*, has a two-step method for deleting records. First, you mark records for deletion, for example, by pressing the Delete key while you view a record. Then you "pack" the database to purge all records that are marked for deletion. This approach lets you change your mind before actually removing the "deleted" records. Further, it allows you to ignore these records while keeping them on file for audit purposes.

@Base lets you use criteria to choose which records to display, print, delete, replace, and so on. You can edit the criteria in two ways. The easiest way is with the Criteria Prompt command. First, the command asks you to choose the file and the field that you want to search. Next, you pick an operator, such as = or >, and a comparison value. Then, you select Quit to use just the one comparison or And or Or to enter more comparisons. To edit existing criteria or to enter more-complex criteria, you use Criteria Edit.

The Data Crosstab commands allow you to generate summary reports in a wide variety of formats and orientations. You can use the Data Transfer commands to import selected values from a disk-based DBF file into a *Symphony* worksheet. Conversely, you can export worksheet-based databases and spreadsheet data into a new or existing DBF file.

@Base provides support for networked databases. You can open database files for exclusive, primary, or read-only access. With exclusive access, you can read and write data and change the file's structure, and other users can't open the file until you close it. With primary access, you can read and write data, but you can't change the file's structure–and other users can open the file with read-only access. With read-only access, you can open the file for viewing purposes only, thus allowing another user to open it with primary access.

The BASEFUNC.APP add-in supplies 20 custom @functions that work with disk-based databases. You can use these @functions in worksheet formulas, criteria formulas, and macros. The *@Base* @functions fall into three classes: statistical, logical, and file manipulation. All of the functions begin with the characters @DB, and many of them, especially the statistical and logical functions, are analogous to *Symphony*'s @D functions. The file-manipulation functions give you extensive control over disk-based databases, including letting you open and close files.

@Base allows you to open multiple database files simultaneously, but it does not provide explicit support for multifile, or relational, operations. You can, however, combine @functions to perform certain multifile tasks.

Personics markets additional *@Base* add-in modules. The *@Base Option Pac* gives *@Base* full support of *dBase*'s NDX index files, which accelerate data access. With the *@Base Option Pac*, *@Base* can perform relational operations and can use automatically computed fields in the Form mode. The forthcoming *@Base Report Writer* provides a simple method for creating database reports. Personics also sells similar *@Base* add-ins for *1-2-3* Releases 2.01 and 2.2.

If you plan to use *@Base* on existing *dBase* applications, keep in mind that data changes you make in *@Base* alter the actual DBF files. Thus, you should adopt the same security and backup precautions with *@Base* applications that you practice with your *dBase* programs. Also, *@Base* ignores, but does not damage, *dBase*'s memo fields, and unless you use the *@Base Option Pac*, it does not support *dBase*'s index files. If you've added or deleted records or changed the values of key fields, you should issue a Reindex command from within *dBase* to update the index or indexes.

A Bridge from a View

Symphony Release 2.2 provides virtually the same file-linking technology that *1-2-3* Release 2.2 has. Specifically, it lets you create direct links between the worksheet in memory and any number of disk-based worksheets. You create a formula that references the disk-based worksheet by file name and cell address, such as +<<SALES.WR1>>C10.

Like *1-2-3* Release 2.2, *Symphony* Release 2.2 can link to any *Symphony* or *1-2-3* worksheet file except *1-2-3* Release 3's WK3 files and *1-2-3/G*'s WG1 files. See the Help/2.2 column in this issue for the fundamentals of file linking in *Symphony* and *1-2-3* Releases 2.2.

Although the file-linking capabilities of the new release of *Symphony* and *1-2-3* Release 2.2 are nearly identical, *Symphony* provides a distinctive, easy method for creating the links. An included add-in, VIEWER.APP, uses *Magellan* viewer technology to let you view worksheet files without actually retrieving them, which is especially useful for file linking. When you attach this add-in, View appears on *Symphony*'s File menu. Selecting View presents three menu options: Retrieve, Link, and Browse.

The Retrieve option lets you preview *Symphony* and *1-2-3* worksheets before retrieving them. You can see the entire file by moving the cell pointer and scrolling through the worksheet. Those who work with a lot of files or with very large files will benefit the most. There is nothing more frustrating than having to retrieve file after file to find the right one, especially if you work with massive files that take 10 minutes to load.

The Link option is a variation of the Retrieve command. It allows you to view the desired worksheet for file linking. First, you position the cell pointer in the cell where you want to enter the link formula. Then, you select SERVICES File View Link and select the desired file. Next, you move the cell pointer into the view of the disk-based worksheet and highlight the cell you want to reference. When you press Return, the linking formula appears in the current cell.

Finally, the Browse option lets you view all files, not just worksheets. However, the package includes special viewers (VWA files) that support only the following file formats: *1-2-3* (WKS and WK1), *Symphony* (WRK and WR1), *dBase* (DBF), and text files (any extension). These viewers show the contents of these files in their native format (for example, *1-2-3* files appear as *1-2-3* worksheets). Files that do not fall into one of the supported types are shown unformatted.

The Viewer lets you view files only in the current default directory. To view files in another directory, first select SERVICES File Directory and specify the appropriate directory.

The Viewer add-in is derived from *Magellan*, but it is only a portion of the *Magellan* system. The add-in supports viewing only, and not other key *Magellan* features, such as full-text searches and disk backup. And the Viewer add-in can't use the VWR or VW2 viewer files that work with *Magellan*.

Publish and Cherish

Allways is not new to this release, but it will be new to most *Symphony* users, except those who purchased or upgraded to *Symphony* Release 2.0 Plus, the minor update that Lotus released late last year. *Allways* is a spreadsheet-publishing add-in that lets you enhance spreadsheets by specifying such attributes as fonts, underlines, borders, and shading.

The *Allways* technology implemented in *Symphony* Release 2.2 is the same as that found in *Symphony* Release 2.0 Plus and *1-2-3* Release 2.2, except that it lets you use the EDIT key (F2) within the *Allways* mode. In previous versions of *Allways*, if you wanted to change cell contents, you had to return to SHEET mode (Ready mode in *1-2-3*) and then switch back to *Allways* to see how the changes looked. Now you can change both the look and the contents of cells without a lot of extra keystrokes.

Tiny Steps

Like *1-2-3* Release 2.2, *Symphony* provides an enhanced Step mode for macro debugging. As in other versions of *Symphony*, you activate the Step mode by pressing Alt-F7.

In Step mode, macros execute one operation at a time. Each time you press the Return key, *Symphony* performs the next macro operation.

When you use Step mode in *Symphony* Release 2.2, the current line of macro code appears at the bottom of the screen. To the left of the macro line is its cell address, and the next operation to be performed is highlighted. These enhancements make it considerably easier to locate problems in a macro.

Database applications are no longer limited to available RAM.

One more feature of *Symphony* Release 2.2 is its support of most of the display and printer drivers that are provided with *1-2-3* Release 2.2. This includes such display modes as EGA 80x43 and VGA 80x43 and several newer models of dot-matrix and laser printers that *Symphony* did not previously support.

Symphony Release 2.2 retails for $695. Registered users of any release of *Symphony* can upgrade for $150 through participating authorized Lotus upgrade resellers, through Lotus Selects, or directly from Lotus.

Symphony Release 2.2 requires an IBM, Compaq, or Lotus-certified compatible computer, a hard disk and a floppy-disk drive, 512K of conventional memory (640K if you're going to use add-ins), and DOS 2.0 or higher.

Bob Quinn is a product manager for Lotus Development Corp. Donald Quinn is a CPA with his own accounting practice and president of Q-Soft Inc.

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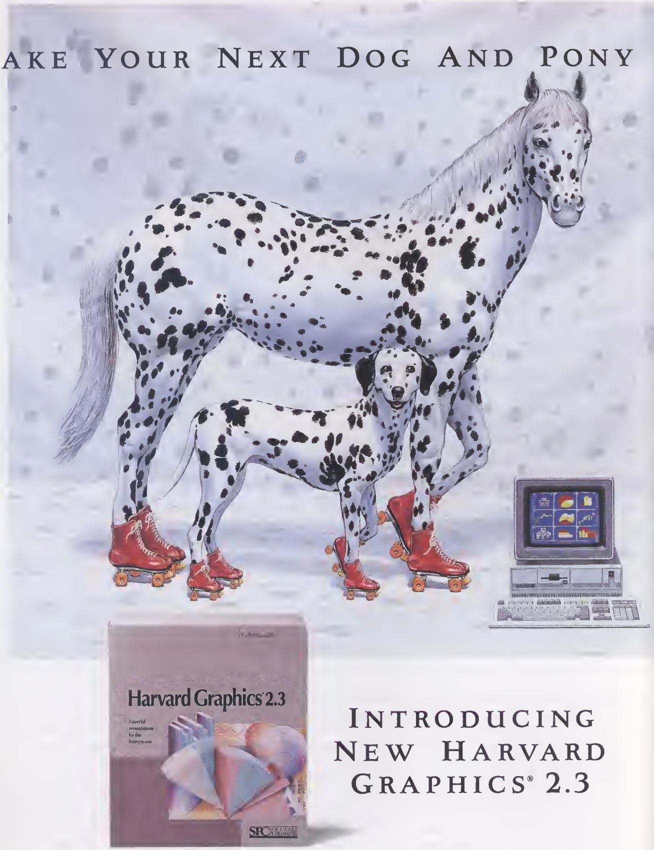
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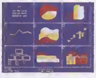
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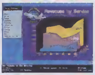

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Do You Know What Your Money Is Doing?

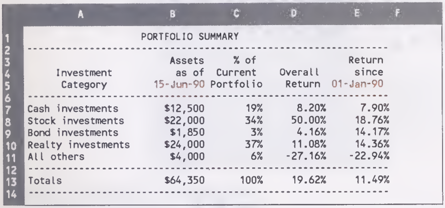
This database template monitors your investment portfolio.

BY STEPHEN L. NELSON

Most financial experts recommend a portfolio of diversified investments to sustain asset growth and minimize the damage from unexpected losses. But a portfolio that has accumulated a number of investments isn't always easy to monitor. And if you haven't found an easy way to scrutinize your portfolio regularly, your investments may not conform to your strategy. Worse, you could be missing more-lucrative investment opportunities.

It isn't hard to construct a *1-2-3* or *Symphony* worksheet to track individual investments and summarize your portfolio by investment type. You can use such a template to measure growth over the life of your investments or for any specific period. In addition, you can uncover the unrealized tax gains and losses lurking in your portfolio.

To sort and track the funds in your individual retirement accounts, pension plans, mutual funds, money market funds, stockbrokerage accounts, certificates of deposit, and other investments, construct the model by using the instructions in the box on pages 62 and 63.



```
        A               B          C          D          E     F
1                      PORTFOLIO SUMMARY
2   ----------------------------------------------------------
3                     Assets      % of                Return
4      Investment      as of    Current    Overall     since
5       Category    15-Jun-90 Portfolio    Return  01-Jan-90
6   ----------------------------------------------------------
7   Cash investments   $12,500       19%      8.20%      7.90%
8   Stock investments  $22,000       34%     50.00%     18.76%
9   Bond investments    $1,850        3%      4.16%     14.17%
10  Realty investments $24,000       37%     11.08%     14.36%
11  All others          $4,000        6%    -27.16%    -22.94%
12  ----------------------------------------------------------
13  Totals             $64,350      100%     19.62%     11.49%
14  ----------------------------------------------------------
```

FIGURE 1. The portfolio summary counts all the assets you enter in your investment register (see page 60). It tracks overall returns for each asset group, plus the rate of return during any specific interval you choose.

The Portfolio Summary

The summary shown in figure 1 provides a snapshot of the portfolio. Formulas in column B add up the assets in each category, and formulas in column C calculate each category as a percentage of the total. In this example, 19% of the portfolio's total assets are in cash investments, 34% in stock investments, and so on. This summary divides the portfolio into five classes of assets: cash, stocks, bonds, real estate, and other investments.

In figure 1, only cells B5 and E5 require user input. The input in cell B5, June 15, 1990, tells the model to measure your investments' progress from the time they were acquired through June 15 of this year.

The date you enter in cell E5 is an intermediate point for checking investment growth for all investments from a specific point in time to the ending date. In the example, cell E5 is January 1, 1990. This input helps frame the question, "What progress have my investment groups and individual investments made between the beginning of the year and June 15?"

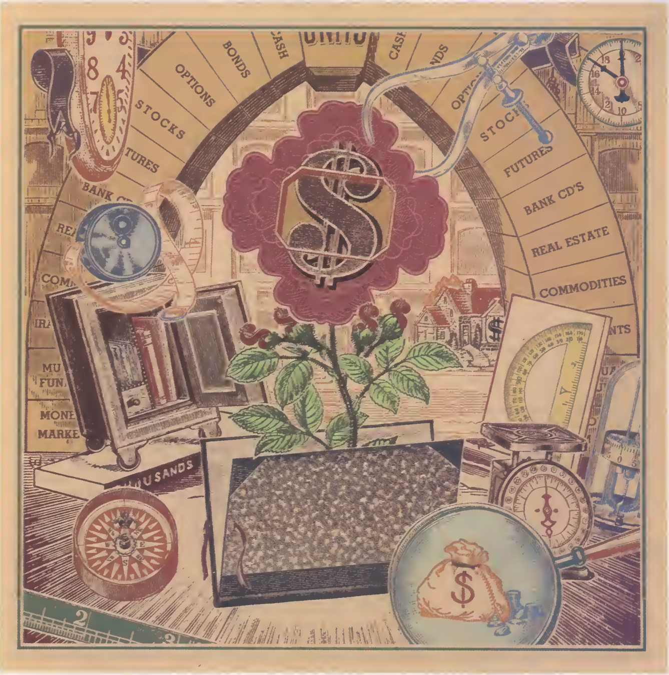
Columns D and E of the portfolio summary use these dates along with the @RATE function to calculate the rates of return for each of your investment categories. Column D calculates an overall rate of return, while column E calculates the rate of return between the two dates you entered—in this case, between January 1 and June 15. In the example, the stocks in the portfolio have appreciated at an annual average rate of 50% since they were acquired. Between January 1 and June 15, they appreciated at an annual average rate of 18.76%.

The Investment Register

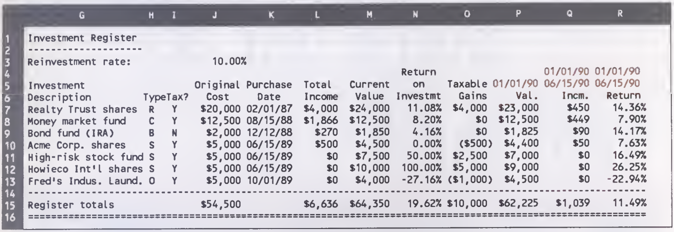
The summary information comes from data entered in the investment register in figure 2. Press the HOME key and then the Tab key (in *Symphony*, hold down the Control key and press the RightArrow key) to see the investment register on your screen.

If you used the instructions in the setup box, the investment register will contain the entries shown in figure 2. The labels and values you entered in columns G through M pertain to individual assets.

Column G contains the name or a brief description of the asset. In column H, a one-letter code identifies the asset, based on the categories shown in figure 3. For example, each of the three stock investments in rows 10 through 12 is marked with an *S*, while the bond investment in row 9 is marked with a *B*. The model's



JOHN CRAIG



	G	H	I	J	K	L	M	N	O	P	Q	R
1	Investment Register											
2	-------------------											
3	Reinvestment rate:			10.00%								
4								Return			01/01/90	01/01/90
5	Investment			Original	Purchase	Total	Current	on	Taxable	01/01/90	06/15/90	06/15/90
6	Description	Type	Tax?	Cost	Date	Income	Value	Investmt	Gains	Val.	Incm.	Return
7	Realty Trust shares	R	Y	$20,000	02/01/87	$4,000	$24,000	11.08%	$4,000	$23,000	$450	14.36%
8	Money market fund	C	Y	$12,500	08/15/88	$1,866	$12,500	8.20%	$0	$12,500	$449	7.90%
9	Bond fund (IRA)	B	N	$2,000	12/12/88	$270	$1,850	4.16%	$0	$1,825	$90	14.17%
10	Acme Corp. shares	S	Y	$5,000	06/15/89	$500	$4,500	0.00%	($500)	$4,400	$50	7.63%
11	High-risk stock fund	S	Y	$5,000	06/15/89	$0	$7,500	50.00%	$2,500	$7,000	$0	16.49%
12	Howieco Int'l shares	S	Y	$5,000	06/15/89	$0	$10,000	100.00%	$5,000	$9,000	$0	26.25%
13	Fred's Indus. Laund.	O	Y	$5,000	10/01/89	$0	$4,000	-27.16%	($1,000)	$4,500	$0	-22.94%
14	----------											
15	Register totals			$54,500		$6,636	$64,350	19.62%	$10,000	$62,225	$1,039	11.49%
16	==========											

FIGURE 2. The Investment Register computes the rate of return and taxable gains for individual assets.

criterion ranges include lowercase letters, so you can also use lowercase letters to identify these investment types.

In column I, you mark an investment as taxable or nontaxable. For the most part, investment gains are taxed when you sell the asset. The exceptions to this rule usually relate to tax-deferred accounts, such as employer pension and profit sharing plans and Individual Retirement Accounts. For more information on this point, refer to a tax-preparation guide.

The information in columns J, K, and L comes straight from your financial records. Enter the original gross cost of the investment in column J. In most cases, this includes commissions or fees incurred to acquire the asset. Use the @DATE function to record the date of the acquisition in column K.

To get an accurate measure of an asset's rate of return, you must take into account both the asset's appreciation and the income generated while you have owned it. Enter the total before-tax income over the life of the asset in column L. For most assets, this will simply be the dividends or interest received.

The current value of the asset—in this case, the value on June 15, 1990—goes in column M. For an accurate calculation of the rate of return and tax liabilities, you should estimate a sales commission. Then in column M, enter the current asset value minus the estimated commission. For example, the Acme Corp. shares in this portfolio have a market value of $4,600. But since the commission for selling the shares would be about $100, their real value in the portfolio is only $4,500. This is also the amount used to figure tax gain or loss. Therefore, cell M10 contains $4,500 instead of $4,600.

Rate of Return and Tax Liability

In column N, the investment register calculates the rate of return for individual assets, from the time you acquired them through the date you entered in cell B5.

In this portfolio, Howieco International stock is the star performer. Cell K12 shows that the stock was acquired on June 15, 1989. The cost was $5,000, which is shown in cell J12. Its value as of June 15, 1990, the date you entered in cell B5, is $10,000, which appears in cell M12. The stock has doubled its value in exactly a year—the 100% gain reported in cell N12.

The mathematical constraints of the @RATE function make the formulas in column N somewhat long and complex. Column N takes into account both asset appreciation and income in determining return on investment. However, if the formula counted income as a lump sum, it would skew the results for income-producing investments, especially for those that have been in the portfolio for a long time.

To correct for this deficiency while retaining the flexibility of the @RATE function, the formulas in column N (and columns D, E, and R, as well) split the total income into equal yearly payments and then use the @FV function to compound these payments. The @FV function uses the reinvestment rate in cell J3 to make this calculation.

In this example, the reinvestment rate is 10%. So if an asset had been in the portfolio for three years and showed a total income of $300 in column L, the formula in column N would assume that the income had been earned at a rate of $100 per year and would have compounded the $100 amounts by 10% a year.

This method isn't a precise way to measure rate of return because payments and compounding don't necessarily occur on an annual basis. But the result is fairly close to the true rate of return. This isn't necessarily true, however, for assets whose income occurs in widely varying amounts or at irregular intervals. The formula *is* precise for assets that aren't earning income.

Press the Tab key again to view the remaining four columns of the investment register. Column O shows the taxable gains or losses associated with each asset. If you enter *Y* or *y* in column I to identify an asset as subject to capital gains, column O subtracts the original cost from the current value to find the tax gain or loss you'll have if you sell the asset.

For example, the Realty Trust shares in row 7 were purchased for $20,000, including commission. If they were sold on the current date, the portfolio's owner would net $24,000 after commissions. The $4,000 difference is the potential taxable income. On the other hand, gains or losses on the bond fund shown in row 9 will not show up in column O because you entered *N* in cell I9.

Reviewing the unrealized tax gains and losses in your portfolio may help you discover tax-saving opportunities. There's much talk of changing the way capital gains are taxed, but as of this writing the rules are fairly simple. For all the assets sold during any given tax year, subtract the losses from the gains. If the net result is positive, you pay taxes on the gain at your marginal tax rate. If the net result is negative, you can use up to $3,000 (or $1,500 for a married taxpayer filing a separate return) of the loss as a deduction in the current year. Any excess above this amount can be carried over and used in future years.

The inputs in colums P and Q correspond to the date you entered in cell E5. To calculate the annual rate of return for an asset between January 1, 1990, and the current date (June 15), you must know the value of the asset on January 1 (column P) and the amount of income it has generated since then (column Q). The annualized rates of return for individual assets for the period January 1 through June 15 are calculated by the formulas in column R.

How the Model Works

The model relies heavily on two @functions: @DSUM and @RATE. The portfolio summary uses @DSUM formulas to categorize your investments into the groups you have defined.

The @DSUM function uses the syntax: @DSUM(*database, offset, criterion*). The @DSUM formulas in column B use the range named *db*, which contains information about individual assets, as its database argument. Each formula in column B uses an offset value of 6 and one of the criterion ranges shown in figure 3.

For example, the formula in cell B8 reads @DSUM($db,6,stock). This formula locates all entries in *db* that are marked as type *S* or *s*—either of which is a criterion for *stock*—and then adds the values that are six columns to the right of column G, the first column in *db*. Since the entries in rows 10, 11, and 12 meet this criterion, the formula in cell B8 adds together 4,500, 7,500, and 10,000 for a total current stock value of $22,000.

@RATE calculates an annual rate of return using the following syntax: @RATE(*future_value, present_value, period*). The @RATE formula in cell N11 of the investment register is a simple example. *Future value* is actually the current value less commissions, or $7,500. Added to that is the future value of a total income of $0, which is $0. *Present value* is actually the original cost, $5,000. *Period* is calculated by subtracting the purchase date from the current date and dividing the difference by 365. This asset was purchased exactly one year earlier. So the formula calculates the one-year rate of return on an asset that grew in value from $5,000 to $7,500: 50.00%

The @RATE formulas in column D of the portfolio summary are more complex. They use @DSUM formulas to determine the total current value, original cost, and number of days that any investment type, say stocks, has been in the portfolio. For example, each of the three stock investments in the portfolio was acquired for $5,000 one year earlier. The respective returns are 0.00%, 50.00%, and 100.00%. Because the stocks originally cost the same amount, the formula weights them equally and computes a 50.00% average return in cell D8.

If one of the stock investments had been bought on a different date or at a different price, this would change the computation of the weighted average in cell D8. For example, what if the high-risk stock fund had been acquired on June 15, 1987, instead of June 15, 1989? You would still have the same amount of money in your portfolio, but a slower-moving asset in the stock group would lower the overall stock return in cell D8 to about 27.58%.

The @RATE formulas in column E work similarly to those in column D, except that they cover performance over a specific period of time. So while cell D9 shows that the bonds in the example have had a low rate of return over the long haul, their performance between January 1 and June 15, shown in cell E9, has been above the portfolio's average rate of return during this period.

Adjusting the Model

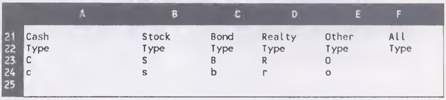
It's easy to modify the investment register for your own portfolio. First, enter the current date in cell B5. If you're doing the calculation for a specific date, use the @DATE formula to enter the date, or edit the existing @DATE formula. If the calculation involves today's values, enter the formula @INT(@NOW).

Enter a reinvestment rate in cell J3. This rate is an estimate, but a good benchmark might be the going rate on one-year Treasury bills.

Erase all entries in ranges G7..M13 and P7..Q13. Then enter information for the assets. If you don't need all seven blank rows, start entering assets in row 13 and work your way up. Then move the labels at the top of the database (range G1..R6) to the row just above your first entry. If you need more rows, place the cell pointer in row 13, select /Worksheet Insert Row (in *Symphony*, MENU Insert Rows) and indicate the extra rows needed. Make sure that no blank rows are left in the investment register after you've entered all the assets.

Enter a category code for each investment recorded in the register. These codes must correspond to the categories that appear in the criterion ranges shown in figure 3. You can add, delete, or change categories.

For example, if you trade precious metals but never buy bonds, change the label in cells A9 and C21 to reflect metals rather than bonds. Alter the labels in cells C23 and C24 to *M* and *m*. As soon as you add one of these investments to the investment register and mark it with an *M* or *m*, it will show up in the portfolio summary. The formulas there will no longer evaluate to 0 or ERR. The model retains the range name *bond*, which now serves as the criterion range for metals. Keep in mind that there must be a blank criterion record in the *All* category.



	A	B	C	D	E	F
21	Cash	Stock	Bond	Realty	Other	All
22	Type	Type	Type	Type	Type	Type
23	C	S	B	R	O	
24	c	s	b	r	o	
25						

FIGURE 3. @DSUM formulas in columns D and E (figure 1) and range J15. O15 (figure 2) use these criterion ranges to classify your assets by type.

Adding categories takes more work. To add a category for options, for example, enter the following labels:

Cell	**Label**
G21	*Options*
G22	*Type*
G23	*P*
G24	*p*

Notice that you can't use *O* or *o* as the category code, because *O* is already the code for *Other* investments—those that don't fit neatly into any category that has already been defined. Use the Range Name Create command to assign the range name *opt* to range G22..G24.

Adjust your portfolio summary to reflect the new category. To do this, move range A11..E14 to cell A12. Range A11..E11 should now be blank. Add the following labels and formulas:

Cell	**Entry**
A11	Options Trading
B11	@DSUM($db,6,opt)
C11	+B11/B14
D11	@RATE(B11+@FV(@DSUM($db,5,opt)/((B$5–@DAVG($db,4,opt))/365),$J$3,(B$5–@DAVG($db,4,opt))/365),@DSUM($db,3,opt),(B$5–@DAVG($db,4,opt))/365)
E11	@IF(@DCOUNT($db,1,opt)<>@DCOUNT($db,10,opt),@NA,@RATE(B11+@FV(@DSUM($db,10,opt)/((B$5–E$5)/365),$J$3,(B$5–E$5)/365),@DSUM($db,9,opt),(($B$5–$E$5)/365)))

Finally, use the Range Format (in *Sym-*

HOW TO SET UP THE PORTFOLIO-ANALYZER WORKSHEET

1. Releases

This model works in *1-2-3* Releases 2.01 and higher and in *Symphony* Release 2.0.

2. Column widths

Column	**Width**
A	20
B	12
D	11
E	11
F	4
G	20
H	4
I	4
J	10
L	8
N	8

For example, to set the width of column A, place the cell pointer in column A, select /Worksheet Column Set-Width (*Symph:* MENU Width Set), and enter *20*.

3. Cell formats

Format	**Range**
Date 1	B5, E5
Date 4	K7..K13, P4..R6
Currency 0	B7..B13, J7..J15, L7..M15, O7..Q15
Percent 0 (*Symph:* % 0)	C7..C13
Percent 2 (*Symph:* % 2)	D7..E13, J3, N7..N15, R7..R15
Hidden	K15

For example, to assign the Date 1 format to cell B5, select /Range Format Date 1 (*Symph:* MENU Format Date 1), indicate cell B5, and press Return.

4. Labels

Enter all labels in figures 1, 2, and 3. Do not enter the cells that appear in brown.

To create the rows of dashed lines, enter \- in cell A2 and copy it as necessary. To create the row of double dashed lines, enter \= in cell G16 and copy it to range H16..R16.

To align the labels to match the figures, press slash (*Symph:* MENU), select Range Label Right, and indicate ranges B3..E5 and O5..R6. Press slash (*Symph:* MENU), select Range Label Center, and indicate ranges A3..A5, H7..I13, and J4..N6.

5. Values

Enter values shown in ranges J3, J7..J13, L7..M13, and P7..Q13 of figure 2.

6. Range unprotect

To make the data-entry cells stand out from the rest of the worksheet, select /Range Unprotect (*1-2-3* Releases 2.2 and 3, /Range Unprot; *Symph:* MENU Range Protect Allow-Changes) and indicate the following cells and ranges: B5, E5, G7..M13, and P7..Q13.

7. Range names

Name	**Range**
db	G6..R13
cash	A22..A24
stock	B22..B24
bond	C22..C24
realty	D22..D24
other	E22..E24
all	F22..F24

For example, to assign the name *db*, press slash (*Symph:* MENU), select Range Name Create, enter *db*, and indicate range G6..R13.

8. Cell formulas

Note: Some cells will evaluate to ERR until all formulas have been entered.

Cell	**Formula**
B5	@DATE(90,6,15)
E5	@DATE(90,1,1)
B7	@DSUM($db,6,cash)
B8	@DSUM($db,6,stock)
B9	@DSUM($db,6,bond)
B10	@DSUM($db,6,realty)
B11	@DSUM($db,6,other)
B13	@SUM(B7..B11)
C7	+B7/B$13

Copy cell C7 to range C8..C11.

C13	@SUM(C7..C11)

The following five formulas perform identical calculations for the criterion-range name that appears five times in each of them. If you're adept at editing formulas, just enter the formula for cell D7 and copy it to range D8..D11. Then edit the formulas in range D8..D11, adding the correct range name (*stock*, *bond*, and so forth) in the five places where it's required in the formula.

D7	@RATE(B7+@FV(@DSUM($db,5,cash)/((B$5–@DAVG($db,4,cash))/365),$J$3,(B$5–@DAVG($db,4,cash))/365),@DSUM($db,3,cash),(B$5–@DAVG($db,

phony, MENU Format) command to make the formats for these cells correspond to the formats used in the columns in figure 1. When you enter an options record, these formulas will no longer evaluate to 0 or ERR.

A Few Tips

The interim-return part of the model—column E in the portfolio summary and columns P, Q, and R in the investment register—is optional. If you don't want to measure a portfolio's growth over a set period of time or don't have the necessary information, leave columns P and Q blank. The formulas in columns E and R will return NA for any asset or group of assets that is missing entries in columns P and Q.

Once you've entered an asset, leave it in the register until it is sold. If a portion of an asset is sold, though, adjust the register entry. If half the interest in the high-risk stock fund in the example were sold, you would change the original cost (cell J11) from $5,000 to $2,500.

As shown in the entry for the money market fund in the example, there is no capital appreciation on short-term cash assets. The interest collected is counted as current income and taxed accordingly.

Finally, keep in mind that more-complex investments, such as real estate, require a separate analysis. This template provides fairly sophisticated formulas for sorting through paper investments, but assets that depreciate or are subject to complex tax rules require a customized template. ■

Stephen L. Nelson, CPA, is a consultant in Seattle and the author of *The Lotus 1-2-3 Money Manager*, published by Microsoft Press.

```
           4,cash))/365)
D8     @RATE(BB+@FV(@DSUM($db,
           5,stock)/((B$5–@DAVG
           ($db,4,stock))/365),
           $J$3,(B$5–@DAVG
           ($db,4,stock))/365),
           @DSUM($db,3,stock),
           (B$5–@DAVG($db,4,
           stock))/365)
D9     @RATE(B9+@FV(@DSUM($db,
           5,bond)/((B$5–@DAVG
           ($db,4,bond))/365),
           $J$3,(B$5–@DAVG
           ($db,4,bond))/365),
           @DSUM($db,3,bond),(B$5–
           @DAVG($db,4,bond))/365)
D10    @RATE(B10+@FV(@DSUM($db,
           5,realty)/((B$5–@DAVG
           ($db,4,realty))/365),
           $J$3,(B$5–@DAVG
           ($db,4,realty))/365),
           @DSUM($db,3,realty),
           (B$5–@DAVG($db,4,
           realty))/365)
D11    @RATE(B11+@FV(@DSUM($db,
           5,other)/((B$5–@DAVG
           ($db,4,other))/365),
           $J$3,(B$5–@DAVG
           ($db,4,other))/365),
           @DSUM($db,3,other),
           (B$5–@DAVG($db,4,
           other))/365)
D13    +N15
```

The next five formulas perform identical calculations except for the criterion-range name that appears four times in each of them. You can enter the first formula, then copy and edit it by using the process described for formulas in column D.

```
E7     @IF(@DCOUNT($db,1,cash)<>
           @DCOUNT($db,10,cash),
           @NA,@RATE(B7+@FV(@DSUM
           ($db,10,cash)/((B$5–E$5)/
           365),$J$3,(B$5–E$5)/
           365),@DSUM($db,9,cash),
           ((B$5–E$5)/365)))
E8     @IF(@DCOUNT($db,1,stock)<>
           @DCOUNT($db,10,stock),
           @NA,@RATE(BB+@FV
           (@DSUM($db,10,stock)/
           ((B$5–E$5)/365),
           $J$3,(B$5–E$5)/365),
           @DSUM($db,9,stock),
           ((B$5–E$5)/365)))
E9     @IF(@DCOUNT($db,1,bond)<>
           @DCOUNT($db,10,bond),
           @NA,@RATE(B9+@FV
           (@DSUM($db,10,bond)/
           ((B$5–E$5)/365),$J$3,
           (B$5–E$5)/365),
           @DSUM($db,9,bond),
           ((B$5–E$5)/365)))
E10    @IF(@DCOUNT($db,1,realty)<>
           @DCOUNT($db,10,realty),
           @NA,@RATE(B10+@FV
           (@DSUM($db,10,realty)/
           ((B$5–E$5)/365),$J$3,
           (B$5–E$5)/365),@DSUM
           ($db,9,realty),
           ((B$5–E$5)/365)))
E11    @IF(@DCOUNT($db,1,other)<>
           @DCOUNT($db,10,other),
           @NA,@RATE(B11+@FV
           (@DSUM($db,10,other)/
           ((B$5–E$5)/365),
           $J$3,(B$5–E$5)/365),
           @DSUM($db,9,other),
           ((B$5–E$5)/365)))
E13    +R15
J15    @DSUM($db,3,$all)
K7     @DATE(87,2,1)
K8     @DATE(88,8,15)
K9     @DATE(B8,12,12)
K10    @DATE(B9,6,15)
K11    @DATE(89,6,15)
K12    @DATE(B9,6,15)
K13    @DATE(89,10,1)
K15    @DAVG($db,4,$all)
L15    @DSUM($db,5,$all)
M15    @DSUM($db,6,$all)
N7     @RATE(M7+@FV(L7/
           ((B$5–K7)/365),
           $J$3,(B$5–K7)/365),
           J7,(B$5–K7)/365)
O7     @IF(@UPPER(I7)="Y",
           M7–J7,0)
```

Copy range N7..O7 to range N8..O13.

Copy cell N7 to cell N15,

```
O15    @DSUM($db,8,$all)
P5     +E$5
P15    @DSUM($db,9,$all)
Q4     +$E$5
Q5     +$B$5
```

Copy range Q4..Q5 to cell R4.

```
Q15    @DSUM($db,10,$all)
R7     @IF(@COUNT(P7..Q7)<2,@NA,
           @RATE(M7+@FV(Q7/
           ((B$5–E$5)/365),
           $J$3,(R$5–R$4)/
           365),P7,(R$5–R$4)/365))
```

Copy cell R7 to range R8. R13 and cell R15.

Answers to Your Questions About Lotus Products

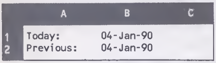
1-2-3 / SYMPHONY

@NOW changes value

Q I often use the @NOW function to display the current date. Unfortunately, when I retrieve a file from disk, the date is immediately updated and I can no longer tell from the worksheet when I last edited the file. Is there some way to keep a cell or range of cells from recalculating without disabling automatic global recalculation?

A. W. Gates
Winnipeg, Manitoba

A It seems that you would be happiest if you could view the current date next to the date that you last edited the file. This is very easy to do. Reserve four cells wherever you normally enter the @NOW function.



	A	B	C
1	Today:	04-Jan-90	
2	Previous:	04-Jan-90	

The entries in column A of the worksheet above are optional, but they clarify the contents of the adjacent cells of column B. Cell B1 contains the @NOW function formatted with the Date 1 format.

Use the Range Value(s) command to preserve the date for your next file retrieval. Select /Range Value (in *Symphony,* MENU Range Values), indicate cell B1 as the range to copy from, and indicate cell B2 as the range to copy to. The Range Value(s) command copies the current value of the @NOW function to cell B2. The original @NOW function remains in cell B1 and displays the current date whenever you retrieve the file.

If issuing the Range Value(s) command just before saving a file is too much trouble, create a macro to do the job for you. Set up your date area as we've described, then enter the label *'/RVtoday:~previous:~* into cell B4. Enter the label *'\d* into cell A4, then assign the labels in column A to the adjacent cells in column B. To do this, press slash (in *Symphony,* MENU), select Range Name Labels Right, and indicate range A1..A4. To date-stamp your worksheet before saving it, hold down the MACRO key (Alt on most computers) and press D.

Run cumulative totals

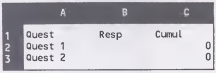
Q Is it possible to calculate cumulative totals without retaining all the data in the worksheet? I want to summarize a survey to get the total number of *yes* responses for each question. I enter a *1* for *yes* and a *0* for *no*. The survey is so large that it is impractical to keep all the data in the worksheet.

I want to maintain one column for the entered data and a second column for the cumulative totals. Can I do this without using circular references?

Andrew Swenson
DSNU
Fargo, N Dak.

A There's nothing wrong with circular references when you use them correctly. Using circular references to keep running totals probably isn't the smoothest spreadsheet application, but this method works if you're careful.

Set recalculation to manual before you enter the accumulation formulas in column C as shown below:



	A	B	C
1	Quest	Resp	Cumul
2	Quest 1		0
3	Quest 2		0

The formula in cell C2 is +B2+C2. Enter it and copy it down column C as needed. After you enter the responses from one survey form, press the CALC key to add the responses from that form to the previous total.

Or use a fourth column to calculate your cumulative totals. To continue with our example, erase range C2..C3, and enter the formula +B2+C2 in cell D2. Copy the formula as needed down column D. Set worksheet recalculation to automatic.

After you enter the survey responses, use the Range Value(s) command to copy the values from column D back into column C. To reduce your efforts for each survey form, assign a range name to the formulas in column D—in this case, assign the range name *forms* to range D2..D3—and assign the range name *cumul* to cell C2. Then enter the label *'/RVforms ~cumul~* in cell E1, and assign it the name \c. To add the most recently entered responses to the running totals, hold down the MACRO key (Alt on most computers) and press C.

1-2-3

Windows or titles

Q When I develop a worksheet, I like to keep the leftmost column and the top row visible at all times. I need two additional windows to do this, but *1-2-3* Release 2.01 lets me open only one window at a time. Is there a solution to this problem?

David S. Licks
Crum & Forster Insurance Co.
Basking Ridge, N. J.

A You can achieve the effect you want by setting worksheet titles.

Suppose you want to lock in row 1 and column A of the worksheet so that they'll remain visible no matter where the cell pointer is. Press Home to move the cell pointer to cell A1. Then press RightArrow and DownArrow. Now select /Worksheet Titles Both.

Row 1 and column A are locked on the display as titles, and the cell pointer is locked out of the titles area. When titles are established, you can't use the Arrow keys to move into row 1 or column A.

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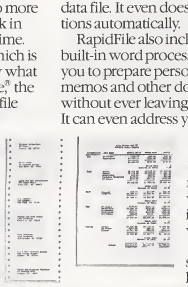

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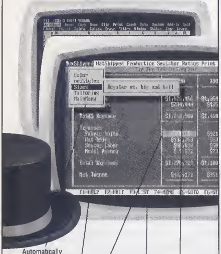
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CIRCLE 110 ON READER SERVICE CARD

If you want to modify a cell in the titles area, issue the Worksheet Titles Clear command, make the change, and then reinstate the titles. Or press GOTO (F5), enter a cell address in the titles area or move the cell pointer into the titles area, and press Return. Make the necessary change, then use the Arrow keys to move the cell pointer out of the titles area. You may need to move the cell pointer beyond the edge of the display to clear the temporarily doubled titles.

ALLWAYS

Problems printing grids

Q When I create construction requisitions and charts of costs, I sometimes add a grid to the worksheet. I can quickly obtain the grid by using *Allways*, but the grid does not appear when I print the chart while using *Sideways*. Can I accomplish what I want?

Len Loitherstein
L. B. Loitherstein Inc.
Newton, Mass.

A Funk Software's technical-service department responded with the following information.

The horizontal and vertical lines are available only in *Allways*. The lines, fonts, shading, and other enhancements you add in *Allways* do not become part of your worksheet.

Sideways sees only the contents of your *1-2-3* spreadsheet, so it can't print the lines that you add using *Allways*. If you want the grid to appear in your printout, you must print with *Allways*, using a printer that can print in landscape orientation. *Allways* currently supports landscape orientation only on laser printers.

Another option is to buy or borrow a wide-carriage dot-matrix printer and use it with *Allways*. A wide-carriage printer allows you to insert the paper sideways. All you need to do is specify in *Allways* that the page dimensions are 11 by 8½ inches instead of 8½ by 11 inches.

Double-strike printing

Q I'd like to print reports in double-strike mode using *1-2-3* and *Allways*. The problem is that *Allways* overrides the setup string for double-strike print, whether I enter it in the *1-2-3* Print menu or embed it in the worksheet.

I use many types of printers, including the Epson FX-100 and FX-286, the Alps ALQ300, and the Star NR-15. Can you help?

Douglas A Johnston
Reno, Nev.

A *Allways* cannot command your printer to print in double-strike mode, and it will override a setup string, whether you enter it in the *1-2-3* menu or embed it in your worksheet.

But *Allways* does provide a few other ways to achieve better-quality output on your dot-matrix printer. If you use one of the three fonts supplied with *Allways* (Triumvirate, Times, or Courier), you can make them darker by using boldface. Just highlight the appropriate cells and select /Format Bold Set or press Alt-B. *Allways* fonts produce excellent results on most dot-matrix printers, particularly 24-pin printers, such as the Epson LQ series.

You can also get better-looking output by using boldface with one of your printer's built-in fonts. However, small type, such as 17- or 20-pitch, or near-letter-quality fonts are not available in enhanced mode on many dot-matrix printers. Refer to your printer manual for more information.

REVISITED

Increase rates by column

In the April issue, page 81, you explained how to increase every value in a column by 10%. The technique you described is valid and even necessary if you use *1-2-3* Release 1A or *Symphony* Release 1, 1.01, or 1.1. However, the Matrix Multiply command makes this procedure considerably easier.

Suppose that you wish to increase every value in column A of the following worksheet by 5%:

	A	B	C
1	4	1.05	
2	6		
3	2		
4	8		
5	4		
6	9		
7	3		

Enter the values shown in the figure. Then select /Data Matrix Multiply and indicate range A1..A7 as the first range to multiply. Indicate cell B1 as the second range to multiply. Finally, indicate cell A1 as the Output range. The increased values will appear in column A.

To perform the same task in *Symphony*, first attach the STAT.APP add-in. Select SERVICES Application Attach and specify STAT.APP. Select Quit to return to the worksheet. Enter the values shown in the figure and then select MENU Range Matrix Multiply. Indicate range A1..A7 as the first range to multiply, cell B1 as the second range to multiply, and cell A1 as the Output range.

Bill Gibson
Product Support Dept
Lotus Development Corp

The Editor replies: Thanks for sharing this solution. Make sure no blank cells are in the first range to multiply or you'll receive an *Invalid matrix* error.

Letters as values

In December, page 87, you suggested that Donald McKague use a table and the @VLOOKUP function to substitute values in formulas with letters that represent the values. For example, he wanted to use the letter E in a formula to represent the value 1.05.

Rather than resort to the cumbersome @VLOOKUP function, why not simply assign the letters as range names for the cells that contain the corresponding values? To do this, enter letters in one column and the values in the adjacent column:

	A	B	C
1	D	1	
2	E	1.05	
3	N	1.1	

To assign each label in column A as a range name for the adjacent cell of column B, press slash (in *Symphony*, MENU), select Range Name Labels Right, and indicate range A1..A3.

Now you can use the letters to represent values. For example, if you type *+D+E+N* in cell B5, the formula will return 3.15.

Gerald Kohn
Homewood, Ill

The Editor replies: Thanks for the improvement. Juan Agudelo of Midland, Mich., offered the same suggestion. He also added that if you copy a formula that contains these range names, the range references will be adjusted to reflect the formula's new location. If you plan to copy the formula and don't want

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CIRCLE 111 ON READER SERVICE CARD

the range references to change, make sure you precede each letter with a dollar sign to make the reference absolute.

Dates on an XY graph

I disagree with your answer to the question posed by D. K. Schattner in the September issue, page 96. If D. K. Schattner specifies a range of date values for the X axis of an XY graph in *1-2-3* Release 1A and uses the Graph Options Scale X-Scale Format Date command, the years appear as 00 instead of 88 (for 1988). You instructed him not to use dates for the X range of an XY graph. If he wants dates to appear along the X axis, you suggested that he select Line instead of XY as the graph type.

This is not correct. I often use date values for the X range of an XY graph in *1-2-3* Release 2.01. If you want *1-2-3* to plot data in data ranges A through F in proportion to elapsed time, you must use an XY graph and the X range must contain date values. A line graph will give incorrect results.

Larry W. Seiler
Pasadena, Tex.

The Editor replies: Of course, using dates in the X range of an XY graph is a reasonable application. In an XY graph, *1-2-3* pairs the values of the X range with the values of the other data ranges to plot the points on the graph. The entries in the X range are treated as values and scaled along the X axis. In a line graph, the entries in the X range are treated as labels and placed at regular intervals along the X axis

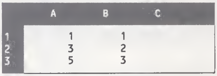
We should have told D. K. Schattner that because the Date format option for the X range does not work for XY graphs in *1-2-3* Release 1A, the year numbers appear as 00. This problem is limited to *1-2-3* Release 1A.

CONTEST

April contest results

In the April issue, we asked readers to create the best method for forcing the @VLOOKUP function to return values from a table only when the lookup value has an exact match in the lookup column. The solution must alert you when the lookup value isn't in the table.

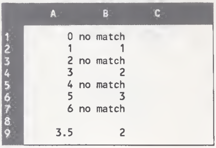
For example, when performing a numeric lookup on the data in the following worksheet, the formula @VLOOKUP (1,A1..B3,1) returns 1. The formula @VLOOKUP(2,A1..B3,1) also returns 1, even though there isn't a 2 in the lookup column. The winning method must force the second formula to alert you if the value 2 isn't in the lookup column of the table.



	A	B	C
1	1	1	
2	3	2	
3	5	3	

Some readers converted the table of values to labels and used the @VLOOKUP function with the @STRING function. But this method forces you to change every entry in the lookup table to a label.

Other readers expanded the lookup table to provide exact matches for every value. They entered the label *no match* in column B opposite every value that might be entered as the lookup value. This method not only requires you to enter the label *no match*, but it also works correctly only when lookup values have exact matches in the lookup column.



	A	B	C
1	0	no match	
2	1	1	
3	2	no match	
4	3	2	
5	4	no match	
6	5	3	
7	6	no match	
8			
9	3.5	2	

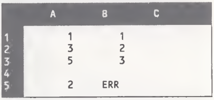
For example, in the screen above, the lookup table is in range A1..B7. The formula @VLOOKUP(A9,A1..B7,1) is in cell B9, and cell A9 contains the lookup value. If the lookup column contains only integer lookup values and you enter the value *3* in cell A9, the @VLOOKUP function in cell B9 evaluates to 2. If you enter the value *3.5* in cell A9, the @VLOOKUP function still evaluates to 2.

Many readers used this formula, in which range A1..B3 is the lookup table and cell A5 contains the lookup value:

@IF(@VLOOKUP(A5,A1..B3,0)=
A5,@VLOOKUP(A5,A1..B3,1),
"Not found")

Although this formula works, a shorter Boolean formula does the job in fewer keystrokes. This winning formula resides in cell B5 in the following figure:

@VLOOKUP(A5,A1..B3,1)/
(@VLOOKUP(A5,A1..B3,0)=A5)



	A	B	C
1	1	1	
2	3	2	
3	5	3	
4			
5	2	ERR	

This formula also assumes that the lookup value is located in cell A5. The second part of the formula, (@VLOOKUP(A5,A1..B3,0)=A5), calculates first. It tests whether the value in cell A5 is exactly represented in the lookup column. If it is, this part of the formula (the divisor) evaluates to 1 (true). If the value in cell A5 isn't exactly represented in the lookup column, the divisor evaluates to 0 (false).

The first part of the formula, @VLOOKUP(A5,A1..B3,1), returns the expected @VLOOKUP result. Dividing the lookup value by 1 (true) returns the exact value. Dividing the lookup value by 0 (false) returns ERR. Any value divided by 0 is undefined in mathematics and evaluates to ERR in *1-2-3* and *Symphony*. An ERR alerts you that the lookup value isn't in the lookup column.

The following readers submitted winning entries: Edmund M. Coleman Jr., Winston-Salem, N.C.; David B. McBrayer, New York, N.Y.; Winston I. Miralles, Fords, N.J.; Walter Wright, Newington, Conn.

This material was prepared by Daniel Gasteiger and the Technical Editors.

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CIRCLE 112 ON READER SERVICE CARD

More Tips on Using Lotus Products

1-2-3 / SYMPHONY

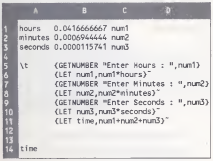
Macro calculates swim times

I use the following macro, which appears in range B5..B11, to calculate and display the swim times of my team. The swim times can be entered as hours, minutes, seconds, or any combination of the three.

Enter the labels shown in range A1..C14. Then enter the following formulas:

Cell	***Formula***
B1	1/24
B2	1/(24*60)
B3	1/(24*60*60)

Assign the labels in column A as range names for the adjacent cells in column B. Select /Range Name Labels Right (in *Symphony*, MENU Range Name Labels Right) and specify range A1..A14. Repeat the command to assign the range names in range C1..C3 to the adjacent cells in range D1..D3. Assign the Time 3 format to cell B14. Set the width of columns B and D to 14. Assign the Fixed format with 10 decimal places to ranges B1..B3 and D1..D3.

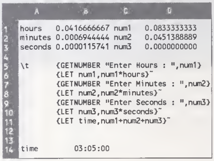


```
       A        B              C           D
1   hours   0.0416666667 num1
2   minutes 0.0006944444 num2
3   seconds 0.0000115741 num3
4
5   \t      {GETNUMBER "Enter Hours : ",num1}
6           {LET num1,num1*hours}~
7           {GETNUMBER "Enter Minutes : ",num2}
8           {LET num2,num2*minutes}~
9           {GETNUMBER "Enter Seconds : ",num3}
10          {LET num3,num3*seconds}~
11          {LET time,num1+num2+num3}~
12
13
14  time
```

To run the macro, hold down the MACRO key (ALT on most computers) and press T.

The macro prompts you for the hours, minutes, and seconds. Enter *2* for hours, *65* for minutes, and *0* for seconds. These values are multiplied by the values in cells B1, B2, and B3, and the results are placed in cells D1, D2, and D3. For example, the LET statement in cell B6 places the result of the formula num1*hours in *num1*. *Hours* equals 1 divided by the number of hours per day, *Minutes* equals 1 divided by the number of minutes per day, and *Seconds* equals 1 divided by the number of seconds per day.

The LET statement in cell B11 adds *num1*, *num2*, and *num3* and places the final result in *time* (cell B14).



```
       A        B              C           D
1   hours   0.0416666667 num1      0.0833333333
2   minutes 0.0006944444 num2      0.0451388889
3   seconds 0.0000115741 num3      0.0000000000
4
5   \t      {GETNUMBER "Enter Hours : ",num1}
6           {LET num1,num1*hours}~
7           {GETNUMBER "Enter Minutes : ",num2}
8           {LET num2,num2*minutes}~
9           {GETNUMBER "Enter Seconds : ",num3}
10          {LET num3,num3*seconds}~
11          {LET time,num1+num2+num3}~
12
13
14  time          03:05:00
```

Steven Burciaga
Grand Rapids, Mich.

Saving templates

I create many worksheet templates in *1-2-3* Release 2.01. If, after I enter data into a template, I don't remember to rename the file when I save it, the template is overwritten. I have to erase all the entries I've made or else use the File Combine Subtract command to recreate the template.

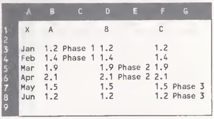
To avoid this, I assign a .WKS extension to all of my template files. The file names appear in the control panel when I select /File Retrieve. When I use the File Save command on a template file, the computer beeps and the message *File will be saved as .WK1* appears in the second line of the control panel. This reminds me to assign a new name to the file.

Joseph Baier
Blue Cross & Blue Shield
Milwaukee, Wis.

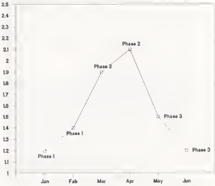
This also works in *1-2-3* Releases 2 and 2.2 and in *Symphony* Releases 1.1 and higher. If you use *Symphony*, assign the .WRK extension to your template file. When you try to save the template file, the message *File will be saved as .WR1* appears

Position those data labels

When I created graphs, I frequently had trouble with data labels running through graph lines or symbols or even overlapping one another. I resolved the problem by creating two or more duplicate data ranges and assigning each a separate set of data labels. For example, I created the graph below from the following data:



```
    A    B    C        D    E        F    G
1   X    A             8             C
2
3   Jan  1.2 Phase 1 1.2            1.2
4   Feb  1.4 Phase 1 1.4            1.4
5   Mar  1.9         1.9 Phase 2 1.9
6   Apr  2.1         2.1 Phase 2 2.1
7   May  1.5         1.5            1.5 Phase 3
8   Jun  1.2         1.2            1.2 Phase 3
9
```



Graph Type: Line

Range	Address
X range	A2..A9
A range	B2..B9
B range	D2..D9
C range	F2..F9

Range	Format
A range	Both
B range	Neither
C range	Neither

Data Labels

Range	Address	Position
A range	C2..C9	Below
B range	E2..E9	Above
C range	G2..G9	Right

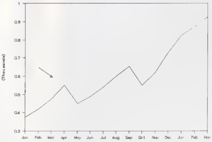
Also, set the lower limit of the Y scale to 1 and the upper limit to 2.5. If you want three different positions for the data labels, as in my example, you need three identical data ranges. To center the graph, include a blank cell at both ends of each graph range. Assign the Neither format to the duplicated graph ranges so that no line or symbols will be displayed. It may take some trial and error to determine the best position for each data label.

This technique is limited by the number of data ranges you have and by the number of different positions you want to assign to the data labels.

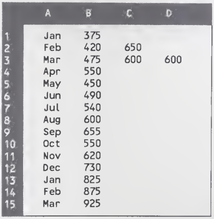
Abigail Amsterdam
Cambridge, Mass.

Add pointers to graphs

If you print graphs in *1-2-3* or *Symphony* but don't have an add-in or a stand-alone graphics-enhancement program, you can use this simple technique to highlight important data in your graphs. I created the following graph in *1-2-3* Release 2.01 and printed it on a Hewlett-Packard HP LaserJet Series II. The graph contains an arrow that points out an early peak in the data series.



I produce the arrow by creating two extra graph ranges. To create the graph, enter the data shown in the following figure.



	A	B	C	D
1	Jan	375		
2	Feb	420	650	
3	Mar	475	600	600
4	Apr	550		
5	May	450		
6	Jun	490		
7	Jul	540		
8	Aug	600		
9	Sep	655		
10	Oct	550		
11	Nov	620		
12	Dec	730		
13	Jan	825		
14	Feb	875		
15	Mar	925		

Now select /Graph Type Line. Set the graph ranges as follows:

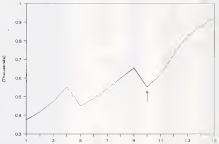
Range	Address
X range	A1..A15
A range	B1..B15
B range	C1..C15
D range	D1..D15

Select Options Format A Lines B Lines D Symbols. Then select Quit Quit View.

In this example, the X and A ranges represent actual data. The B range contains only two entries, which draw the small line that makes up part of the arrow. Since the graph point we want to highlight is the fourth data point in the range, we draw the line using the second and third points. The D range contains only one point, which displays as a solitary triangle. We entered *600* for this data point—equal to the end of the line we used to make the arrow.

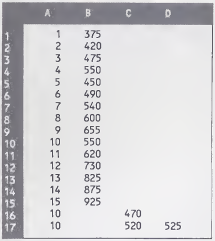
When you use this technique on your own graphs, you'll have to experiment a bit with the data you enter in ranges B and D to get the arrow exactly where you want it. Note that the line in range B must be 45 degrees from the horizontal so that it points directly to the opposite vertex of the triangle. You should also have at least a dozen data points in your graph to draw an arrow of this type. Otherwise, the arrow may appear jagged.

If you want to draw an arrow that points from below, only a vertical line aligns with the top vertex of the triangle. An example of this type of arrow appears in the graph at the top of the next column.



The next figure shows the data used to create this image. This technique works only with an XY graph, so you must use numbers instead of labels in the X range.

To draw this graph, erase ranges A1..A15 and C2..D3 and add the data in ranges A1..A17 and C16..D17 of the following figure.



	A	B	C	D
1	1	375		
2	2	420		
3	3	475		
4	4	550		
5	5	450		
6	6	490		
7	7	540		
8	8	600		
9	9	655		
10	10	550		
11	11	620		
12	12	730		
13	13	825		
14	14	875		
15	15	925		
16	10		470	
17	10		520	525

Then select /Graph Type XY. Set the graph ranges as follows:

Range	Address
X range	A1..A17
A range	B1..B17
B range	C1..C17
D range	D1..D17

Now select View. In this example, we wanted to point to the drop in the tenth data point in the series. Therefore, the extra graph ranges, B and D, must correspond to an X value of 10. This example leaves a small amount of space between the line and the triangle for a crisp arrow.

Kelly Conatser
LOTUS *staff*

Vertical-line indicator on XY graph

I produce graphs to depict staff levels and use this method to insert a vertical line in the graphs to denote the current month. I create the graph with the following settings and set up the titles, data labels, and legends as shown.

Graph Type: XY

Range	*Address*
X range	A4. A18
A range	B4..B18
B range	E4 .E15
C range	F4 .F15
D range	C4 C18

Format

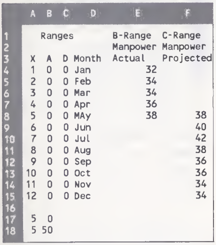
Range	*Format*
A range	Lines
D range	Neither

Data Labels

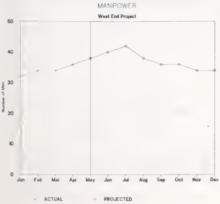
Range	*Address*	*Position*
D range	D4. D15	Below

Titles
First: MANPOWER
Second: West End Project
Y axis: Number of Men

Legends
B: ACTUAL
C: PROJECTED



	A	B	C	D	E	F
1		Ranges			B-Range	C-Range
2					Manpower	Manpower
3	X	A	D	Month	Actual	Projected
4	1	0	0	Jan	32	
5	2	0	0	Feb	34	
6	3	0	0	Mar	34	
7	4	0	0	Apr	36	
8	5	0	0	MAy	38	38
9	6	0	0	Jun		40
10	7	0	0	Jul		42
11	8	0	0	Aug		38
12	9	0	0	Sep		36
13	10	0	0	Oct		36
14	11	0	0	Nov		34
15	12	0	0	Dec		34
16						
17	5	0				
18	5	50				



Select /Graph Options Scale X-Scale Format Hidden (in *Symphony*, MENU Graph 2nd-Settings X-Scale Format Other Hidden). Range A4..A15 of the X range creates the X-axis scale. There are 12 numbers, one for each month of the year. Range A16..A18 places the line at the fifth month. To position the line at another month, replace the values in cells A17..A18 with the new month number.

The A range creates the vertical line. Be sure to enter a number in cell B18 that is greater than or equal to the highest value in the data being graphed. This ensures that the line extends all the way to the top of the graph.

The B range and C range contain the actual data that's graphed. I include the blank cells in the range specifications to produce one continuous line. Because I don't update the actual staff value until the month is over, the actual and projected values for the current month are the same.

The D range contains 12 zeros. Thus, the line associated with these values runs along the X axis.

Steve Bogart
Unisys Corp.
Great Neck, N.Y.

If you use *1-2-3* Release 2.2 or 3, you may have to adjust the Y scale to make sure the vertical line extends to the top of the graph. For this example, select /Graph Options Scale Y-Scale Manual Upper and enter *50*.

OPERATING SYSTEMS

OS/2 running maximum number of programs

A customer had a problem loading *1-2-3* Release 3 under OS/2 version 1.1. When he tried to load *1-2-3*, the copyright screen and the following error message appeared: *1-2-3 cannot continue. Your OS/2 is running the maximum number of programs it can manage at this time.* This problem was easily resolved. The OS/2 THREADS command in his CONFIG.SYS file was set to a number less than 64. The command should be set to 64 or greater.

Margie Rohner
Product Support Dept.
Lotus Development Corp.

The OS/2 THREADS command determines the number of independent actions (threads) that can exist in the system simultaneously. The syntax is THREADS=*n*, where *n* is the number of independent actions. If your CONFIG.SYS file doesn't contain a THREADS command, the system defaults to 64 threads. The minimum and maximum threads allowed are 32 and 255, respectively.

INFORMATION

Lotus product literature

Here's a list of free product literature available from Lotus Development Corp.:

1-2-3
1-2-3/G
1-2-3/M
1-2-3 for Sun
1-2-3 for VAX/VMS
Lotus Add-In Toolkit for Release 3
Lotus Agenda
Lotus @Factory
DataLens Developer Toolkit
Lotus Express
Lotus Freelance Plus
Lotus Freelance Plus Maps
Lotus Graphwriter II
Lotus Magellan
Lotus Manuscript
Lotus Notes
Lotus One Source
Lotus Signal
Symphony
T-A-C (The Application Connection)

Requests are mailed by Lotus Customer Service (800-343-5414) 24 to 48 hours after they are made, provided the literature is in stock. If you're interested in a Lotus product that isn't listed, contact Lotus Customer Service.

Suzanne Chamberlain
Operations Program Management
Lotus Development Corp

This material was prepared by the Technical Editors, with the help of the Lotus Product Support staff.

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CIRCLE 113 ON READER SERVICE CARD

Cell Mates

Use file-linking formulas in *1-2-3* and *Symphony* to avoid redundant work and beat RAM constraints.

BY JUSTIN FIELDING AND JO-ANN SPERA

What if all your financial data could fit in a single worksheet file? Part of the worksheet could tally the revenues and costs for each product line. Other sections could detail tax liabilities, overhead, and so on. You could prepare a corporate profit-and-loss statement without retyping any data: Just set up the headings and summary formulas and reference the appropriate cells.

Despite its convenience, the single-file approach is impractical for most businesses. Depending on the system configuration and software release, RAM will run out sooner or later. As you lump more data into the worksheet, recalculation slows down. And you might find it more manageable to keep different applications in separate worksheets.

In "Here's the Missing Link" (page 34 of the February issue), we showed how *1-2-3* Release 3 helps manage multiple-worksheet applications. Releases 2.2 of *1-2-3* and *Symphony* lack some of the features—such as three-dimensional worksheets, nearly unlimited memory capacity, and the ability to keep several files active at once—that distinguish Release 3 for such projects. For many applications, however, the file-linking features of *1-2-3* and *Symphony* Releases 2.2 provides all the multiple-worksheet capabilities you need.

Cells Copied While-U-Wait

Back when *1-2-3* Release 2.01 and *Symphony* Release 2.0 were Lotus's top-of-the-line products, you had two options for copying data from one existing worksheet to another: Rekey the data or use the File Combine Copy command.

Rekeying is often the fastest technique for small, occasional tasks, but it does increase the risk of typing mistakes. And if the data in the original worksheet changes, you have to transcribe the updated figures into the other worksheet.

MOTION PICTURE AND TELEVISION PHOTO ARCHIVES

The File Combine Copy command lets you copy a range of cells—or the entire worksheet—from a file on disk into the current worksheet file. This command helps eliminate retyping errors, and it's available in all releases of *1-2-3* and *Symphony*. Like rekeying, though, it does not dynamically update worksheets that share data.

File linking is similar to the File Combine Copy command in that it copies values from a disk-based worksheet into the active worksheet. But a file link establishes an ongoing interaction between two worksheet files.

You enter a formula in the file into which you want to copy data (the target file) and have it reference a cell in the file that contains the data (the source file). With Releases 2.2 of *1-2-3* and *Symphony*, the worksheet automatically updates any linked cells—copying the current values from the source file—every time you retrieve the target file. Release 3 users must select the File Admin Link-Refresh command to update linked cells after they retrieve a worksheet.

You may need to use the Link-Refresh command if you use Release 2.2 of *1-2-3* or *Symphony* on a network. If someone else changes the source file while you work on the target file, you can use this command to update your worksheet at any time. Then press the CALC key (F9 in *1-2-3*; F8 in *Symphony*) to update any formulas that depend on the linked cells.

File linking has another major application beyond eliminating retyping. If an application is too large to fit in available RAM, you can split the number-crunching chores among multiple files. When you link to a cell from another worksheet, you bring in the cell's current value, not the formula it contains, nor the data in other cells that helped derive that value. Thus you could use one worksheet as a scratch pad to perform intermediate calculations and then use linking formulas to bring the relevant values into the worksheet that you'll actually print.

Linking Logic

It's easy to create a file-linking formula. Just identify the cell you want to copy with the following syntax: +<<*file name*>>*cell location*. Although it is not mandatory, the file name should include the drive, directory name, and worksheet extension of the source file.

Releases 2.2 of *1-2-3* and *Symphony* can link with any *1-2-3* Release 1A files (WKS), Release 2/2.01 or 2.2 files (WK1), and files from any release of *Symphony* (WRK and WR1). You can also make links to files created with *1-2-3*

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Release 3—as long as you first save them with a .WK1 extension, instead of in the default WK3 format. Note that doing so will strip the file of features that are exclusive to Release 3.

If you do not specify the drive and directory, *1-2-3* and *Symphony* look for the source file in the current default directory. If you do not specify an extension, Releases 2.2 of *1-2-3* and *Symphony* assume the default extension (.WK1 and .WR1, respectively). If, for example, you want *1-2-3* Release 2.2 to link to a *Symphony* Release 2.2 worksheet, you must include .WR1 with the file name.

The cell location can be either a cell reference, such as B23, or a range name that exists in the source file. The formula +<<C:\123\SALES.WK1>>B23 copies the value from cell B23 of a file called SALES.WK1 that resides in the directory C:\123. If cell B23 has been assigned the range name *totalsales*, you can enter the following formula instead:

```
+<<C:\123\SALES.WK1>>totalsales
```

Unlike *1-2-3* Release 3, Releases 2.2 of *1-2-3* and *Symphony* cannot include a reference to an external file within a larger formula. You cannot, for example, use the formula

```
+<<C:\123\SALES.WK1>>B23*10
```

or the formula

```
@SUM(<<C:\123\SALES.WK1>>
  B23..B30)
```

But both formulas would be valid in Release 3.

You can, however, reference a linked cell just like any other worksheet cell. Thus you could enter the formula +<<C:\123\SALES.WK1>>B23 in cell G9 of the target file, and you could enter the formula +G9*10 in cell G10. If you need to sum a range of cells from the source file, you could create a separate linking formula for each cell and then sum the values you copied. Or you could simply enter an @SUM formula in a cell in the source file and then create a formula in the target file that references that cell.

In *1-2-3* Release 2.2, the source file must exist before you write a formula in the target file that references it. This is also true for a *Symphony* Release 2.2 worksheet, unless you first disable the Auto-Link feature, an option that is not available in *1-2-3*. We'll discuss this option and other *Symphony*-specific features in a later section.

When you use linking formulas, a range name is usually preferable to a cell reference. A well-chosen range name is easier to remember. And using one in a linking formula ensures that the formula in the target file continues to identify the right cell even if the range in the source file is moved to another location. Column and row references in the target file do not adjust as you make changes in the source file. Remember to assign the range names in the source file before you try to reference those names in linking formulas.

You can even use linking formulas with certain macro commands, such as {LET}. For example, the following formula will enter into cell C75 of the current worksheet the value of the range *totalsales* from the file SALES.WK1.

```
{LET C75,+<<C:\123\SALES.WK1>>
  totalsales}~
```

While you can use linking formulas to supply a value to a macro, the macro cannot change the value in the source file. You could not, therefore, use the following command:

```
{LET +<<C:\123\SALES.WK1>>
  totalsales,C75}~
```

Whether you use them in a macro or not, linking formulas get a value from a file on disk and copy it into the current worksheet, not vice versa.

The Tie That Binds

As your applications grow in complexity, keeping track of which source files are linked with a worksheet gets harder. If, for example, you plan to copy an application to another computer, you'll need to duplicate all of the relevant files. Fortunately, *1-2-3* and *Symphony* can help you audit the links. You can view a list of files to which the current worksheet is linked by selecting /File List Linked (in *Symphony*, SERVICES File List Linked). As you highlight each file name, the control panel displays the following attributes of the source file: the name of the file, the date and time it was last saved, and its size in bytes. Press Return to go back to Ready mode.

A different way to obtain this information is to choose /File Admin Table Linked (in *Symphony*, select SERVICES File Table, press Return, and select Linked). Much like the Range Name Table command, this command enters information about the worksheet into the worksheet itself. When this command prompts you to specify a range, indicate a cell in a blank area of the worksheet. The resulting table will take up four columns (three in *Symphony*) by as many rows as there are linked files. The first column contains the file name. In *1-2-3* the second and third columns contain date and time serial numbers, while in *Symphony* each entry in the second column is a serial number indicating both the date and time the file was last saved. To make these columns more readable, assign them an appropriate date or time format. In both programs the last column shows the file size in bytes.

The aforementioned commands provide information about the source files that the current worksheet references, but they don't show you which cells contain the linking formulas. In *1-2-3* you can find the cells that contain linking formulas by using the Range Search command and searching for the characters << or the name of the source file. Make sure you choose the options Formulas and Find after you enter the search string.

Symphonic Harmonies

Symphony Release 2.2 includes an add-in that lets you create file links by viewing the source file and pointing to the cell that you want to link with. The Viewer add-in uses some of Lotus's *Magellan* technology to make file linking in *Symphony* even easier than with Release 3's Perspective mode. See "Something Old, New, and Borrowed: *Symphony* 2.2" in this issue for details on using the Viewer add-in.

Another unique feature in *Symphony* is the ability to choose whether file-linking formulas are updated automatically. To disable automatic updating during the current work session, press MENU and select Settings Auto-Link No Quit. When you disable automatic updating, you can enter linking formulas that refer to files or range names that do not yet exist.

Note that some formulas will evaluate to ERR until you refresh the links by using the File Admin Link-Refresh command, or until you restore the updating method to automatic by choosing MENU Settings Auto-Link Yes.

Linking Haze

There are two typical errors in file-linking formulas: The spreadsheet won't let you enter the formula as you specify it, because the file or range name does not exist as you described it, or a file-linking formula that you have entered displays ERR.

1-2-3 and *Symphony* will not let you create a file link to a password-protected file. If the source file is not password-protected and you get an error message when you create the linking formula, carefully examine the linking formula.

Make sure the formula starts with a plus sign and two left-angle brackets (<<) and is immediately followed by the file name. In most applications, the file name should include the drive name, directory name, and file extension. If you omit the drive and directory name and you subsequently change the default directory, the linking formula will no longer be able to find the source files. The handful of keystrokes you save by leaving out the drive, directory, and extension could result in errors later on. However, if you move the application to another drive or directory or convert the source file to another format, you will have to change linking formulas accordingly.

Two right-angle brackets (>>) and the cell reference or range name should immediately follow the file name. To insure that file linking formulas don't change unexpectedly as you alter your worksheet, use absolute references (that is, include a dollar sign before the column and row references or before the range name).

If the syntax you entered appears to be correct but the software still won't accept it, make sure you correctly identified the file name. In *1-2-3* choose /File List Worksheet; in *Symphony* choose SERVICES File List Worksheet. Remember to check for the correct file extension. If you think you identified the file correctly but want to check the range name, save your current file, load the source file, press the GOTO key (F5 on most computers), enter the range name and press Return. If you get an error message, press Escape, assign the appropriate range name, and save the file. When you retrieve the target file, you should now be able to enter the linking formula.

If a linking formula that used to work now displays ERR, the source file or range name either no longer exists or is not accessible as described in the linking formula. Or the file has subsequently been password-protected. Save the current worksheet and try to locate and retrieve the source file from the directory specified in the linking formula.

Justin Fielding is senior editor for Techniques for *LOTUS*. Jo-Ann Spera works in the *1-2-3* Release 2.2 Quality Assurance Department for Lotus Development Corp.

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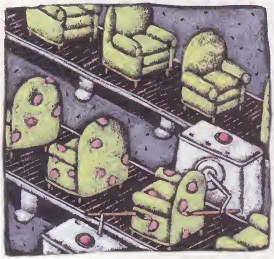
REVIEWS ✓ ✓ ✓

The Guns-and-Butter Equation

What'sBest! and *What-If Analyst* help you allocate your resources for the maximum—or minimum—bang.

BY MARJORIE OSTERHOUT



NICHOLAS WILTON

How can you make the most profit from a fixed quantity of raw goods? How can you schedule your work force to finish a job as quickly as possible? *What'sBest!* ($149 to $3,495) uses "linear programming" to answer such questions in minutes. *What'sBest!* works with *1-2-3* Release 2 or higher or *Symphony* Release 1.1 or higher.

Need to know what combination of resources is necessary to reach a specific goal? *What-If Analyst* ($49.95 or $99.95) uses a technique called goal seeking to solve this kind of problem just as quickly. *What-If Analyst* works with *1-2-3* Releases 2/2.01, 2.2, and 3, and with *Symphony* Releases 1.1 and higher.

Perhaps you need both linear programming and goal seeking. *1-2-3/G*'s Solver feature does both—as well as nonlinear optimization, which solves problems that neither *What'sBest!* nor *What-If Analyst* can tackle. And at this writing, *What-If Analyst*'s publisher planned a May release of *What-If Solver*, a program that also performs all three kinds of problem solving. See the box on the next page for an example of a nonlinear problem and the April 1990 issue of *LOTUS* for more on *1-2-3/G*'s Solver feature.

What'sBest!

An add-in that reads *1-2-3* and *Symphony* worksheets, *What'sBest!* is aptly named. First, you specify the variable cells—the values in your worksheet that can be changed, such as the number of raw goods used or the number of hours a particular employee spends on a project. Next, you specify a constraint for each variable cell, describing the extent to which that cell can be changed. For example, you may decide that the number in a cell representing the number of hours an employee works per day cannot exceed 10. Finally, you pick a target cell containing the value you want to maximize or minimize. *What'sBest!* calculates the values for the variable cells that yield the maximum or minimum value possible for the target cell.

Consider the following example. Your company manufactures sofas and love seats. Each sofa requires three cushions; each love seat, two. A sofa generates a $200 profit; a love seat, $150. You have 250 cushions, 50 sofa frames, and 60 love seat frames in stock. What combination of sofas and love seats will yield the highest profit?

You might reason that because sofas yield a higher profit than love seats, you should use all of the sofa frames (50), and then make as many love seats as you can with the remaining cushions (50). That yields a profit of $17,500. However, *What'sBest!* discovers that if you make 60 love seats and 43 sofas, your total profit will be $17,600. A $100 difference may not seem like much, but in a high-volume situation, small differences can add up to huge gains or losses.

What'sBest! makes only one demand of the worksheet you optimize: The equations in your problem must be linear equations. That means that if you were to draw a graph of any equation in your problem, it would produce a straight line. This requirement makes *What'sBest!* suitable for many applications in manufacturing, staff scheduling, and inventory management. However, in other problems, such as those in engineering or finance, the equations are not always linear. These applications require nonlinear optimization.

What'sBest! is easy to learn and provides several sample worksheets to help you get started. But watch out for a few quirks in its operation. Whenever you optimize a worksheet, *What'sBest!* saves two files automatically: It saves the worksheet in a file called WBTO.WK* (or WBTO.WR*, if it's a *Symphony* file) and saves the optimization in a file named WBFR.WK* (in *Symphony*, WBFR.WR*). You have to remember to rename these worksheets if you want to save them. If you don't, *What'sBest!* will overwrite them the next time you perform an optimization.

What'sBest! works with @SUM, @AVG, and most *1-2-3* and *Symphony* financial @functions. But it doesn't work with other native @functions, with add-in @functions, or with formulas that link a cell to another workseet on a disk. To optimize a worksheet that contains any of these unsupported elements, you must either remove these elements from the worksheet or name the ranges containing them by using a range name that begins with the letters WBOMIT. Otherwise *What'sBest!* will return only an error message.

As mentioned, *What'sBest!* works with

1-2-3 Release 3 worksheets, but it doesn't work with 3-D worksheet files. The add-in will not optimize worksheets containing range or formula annotations—in fact, it will delete both during any attempted optimization. Also, it won't optimize formulas linked to other worksheets in memory or on disk. These incompatibilities mean you may have to redesign some Release 3 worksheets before using them with *What'sBest!*.

What'sBest! is available in five different versions: Personal, Commercial, Professional, 386, and 386W. The versions differ in the number of variables they can handle and the amount of memory they require. The Personal version, which I tested, handles up to 400 variable cells and requires 256K of RAM. The 386W version can handle up to 16,000 variable cells and requires 4 megabytes of RAM. All five versions allow only one target cell.

What-If Analyst

To illustrate *What-If Analyst*'s approach to problem solving, let's return to the furniture-manufacturing example. Suppose that regardless of materials on hand, your company needs a $25,000 profit to meet its goal for this fiscal year. You need to know how many sofas and love seats you have to sell to make this profit. *What'sBest!*'s linear optimization can tell you the maximum or minimum profit possible, but it can't easily solve for a specific profit. But *What-If Analyst*'s goal-seeking technique can solve the problem.

With *What-If Analyst*, you first specify your variable cells. However, you can't specify constraints for these variables. Next, you specify the cells that will contain your goals and the values for the goals—in this case, a profit of $25,000. *What-If Analyst* repeatedly changes the values in the variable cells and recalculates your worksheet until your goals are achieved.

If the equations in your worksheet are linear equations, *What-If Analyst* reaches your goal in one iteration. Nonlinear equations require more iterations, and a large worksheet with nonlinear equations can take minutes to solve. If you don't want to wait that long, the program offers several ways to keep iterations to a minimum. One command lets you specify the number of iterations. Another command lets you view the worksheet after each iteration: If the problem is solved to your satisfaction after any one iteration, you can stop goal seeking. A third command lets you control the precision of your answer to a power of 10. If you relax the precision, *What-If Analyst* requires fewer iterations.

You can also enter trial values for each variable. In this case the program tries to find the values closest to those that yield the desired goal. The more intelligently you select these trial values, the fewer iterations *What-If Analyst* needs to reach the goal.

What-If Analyst comes in two editions: a Standard Edition ($49.95) that allows only one variable cell and one goal cell and requires a minimum of 22K of RAM; and a Premium Edition ($99.95) that solves for up to 10 variable cells and 10 goal cells simultaneously and requires a minimum of 60K of RAM.

Marjorie Osterhout is a free-lance writer living in Boston. She is coauthor of Que Corp.'s forthcoming book *Using 1-2-3/G*.

NONLINEAR OPTIMIZATION

Suppose you want to run advertisements in both your local newspaper and a city magazine. The publications charge different prices, and both yield a known response rate. Because the relationship between advertising dollars and number of responses can be described by a linear equation, you can use a linear optimization program, such as *What'sBest!*, to determine the least-expensive means of generating the number of responses you want to get from the ad campaign.

However, a more-realistic assumption is that the percentage of responses from each publication is an average taken from responses to several previous ad campaigns. The actual number of people who respond to the ads could be higher or lower than this average. To select the optimal investment in this case, you must take into account the likelihood that the number of responses you get to either the newspaper or the magazine will be above or below average. Because this likelihood can't be defined by a linear equation, you need nonlinear optimization to solve the problem.

In May, too late for a thorough review, Frontline Systems released *What-If Solver*, an add-in that uses linear and nonlinear optimization, as well as goal seeking, to solve problems with up to 20 variable cells. *What-If Solver*'s greatest benefit is that you can use it without knowing whether you need linear or nonlinear optimization or goal seeking. The program figures out what you need based on the variables, constraints, and targets you specify.

1-2-3/G, Lotus's graphical spreadsheet for OS/2's Presentation Manager, includes Solver, which also solves linear, nonlinear, and goal-seeking problems. Solver can handle as many variables as can fit in your computer's available memory. And Solver can use OS/2's multitasking capability to run in the background while you work on another project or worksheet. For more information on Solver, see page 7 in the April issue.

IN BRIEF

What-If Analyst Premium Edition Version 1.0. Frontline Systems, P.O. Box 2001, Cameron Park, CA 95682; 800-451-0303, ext. 55. Requires *1-2-3* Release 2/2.01, 2.2, or 3, or *Symphony* Release 1.1 or higher. Runs with *1-2-3* Release 3 under OS/2 Version 1.0 or higher. RAM requirements: Premium Edition requires 60K with *1-2-3* Releases 2.x, 70K with *1-2-3* Release 3, and 80K with *Symphony*. Standard Edition requires 38K with *1-2-3* Release 2.x, 22K with *1-2-3* Release 3, and 48K with *Symphony*. Released 12/89. Premium Edition, $99.95; Standard Edition, $49.95. Free technical support for 90 days after purchase, on a fee basis thereafter. 90-day limited warranty.

What'sBest! Personal Version 1.5. General Optimization, 2251 North Geneva Ter., Chicago, IL 60614; 800-441-BEST, in Ill. 312-248-7300. Requires *1-2-3* Release 2/2.01, 2.2, or 3 or *Symphony* Release 1.1 or higher and DOS 2.1 or higher (does not run under OS/2). Released 3/90. $149; other versions are Commercial ($695), Professional ($995), 386 ($2,995), and 386W ($3,495). One-year limited warranty.

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2 Good	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3 Fair	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4 Poor	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5 N/A	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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Home-Brewed @Functions

Concoct your own with *3-2-1 Gosub* or with *@Tools.*

BY BILL LAWRENCE

How often have you wished for an @function to replace proprietary calculations—calculations you currently perform by using complex formulas or slow, looping macros?

There was a time when you needed the *Lotus Developer Tools* and a knowledge of the complex assembly programming language to create @functions. Now two add-in programs, *3-2-1 Gosub* and *@Tools*, offer more-facile programming methods to create @functions for *1-2-3* Release 2, 2.01, and 2.2.

3-2-1 Gosub generates an @function from a range of formulas in a worksheet. The program comes in two versions. With the Developer Edition ($249.95), you can create @functions that can be used in any *1-2-3* Release 2.*x* worksheet, even without *3-2-1 Gosub* attached. In contrast, @functions you create with the Standard Edition ($99.95) can be used only with *3-2-1 Gosub* attached and only in a worksheet that contains the formulas used to develop those @functions.

@Tools ($299.95) lets you create add-in @functions by using the C programming language. @Functions created with *@Tools* not only simplify *1-2-3* worksheet applications but also add new functionality to *1-2-3*. However, *@Tools* requires more patience and perhaps more expertise than *3-2-1 Gosub*. *@Tools*' manual is incomplete, and the publisher provides no telephone technical support for the product. Neither *3-2-1 Gosub* nor *@Tools* can create @functions for *1-2-3* Release 3. For that, you need the *Lotus Add-In Toolkit for Lotus 1-2-3 Release 3* ($395), which will be reviewed in the August issue.

NICHOLAS WILTON

3-2-1 Gosub

In *1-2-3* you create formulas that reference cells in your worksheet. Using *3-2-1 Gosub*, you create formulas that reference the arguments entered into your @function.

For example, suppose you work for an engineering firm and regularly calculate the volumes of various cylindrical tanks. In *1-2-3* you could create the following formula:

```
3.14*(A1^2)*B1
```

In the formula, the value in cell A1 is the cylinder's radius, and the value in cell B1 is the cylinder's height.

When using *3-2-1 Gosub*, first name the range that contains a formula, giving it the same name as the @function to be created—in this case, *cylvol*. Next, use *3-2-1 Gosub*'s special @functions to reference your variables as arguments rather than cell addresses. The contents of the resulting range, *cylvol*, look like this:

```
@RETURN(3.14*(@ARG(1)
  ^2)*@ARG(2))
```

Now enter the formula @CYLVOL (*radius,height*) anywhere within this worksheet.

@CYLVOL is an example of the simplest type of @function you can create with *3-2-1 Gosub*. The program also makes it easy to create @functions that perform repeating calculations. For example, suppose you need to calculate interest compounded daily. Without *3-2-1 Gosub*, you have to create 365 rows of copied interest formulas or a looping macro that repeatedly calculates one day's interest, adds that interest to the principal to get a new principal amount, and then calculates the next day's interest based on that new amount. By using special @functions in *3-2-1 Gosub*, you can create an @function that will pass each new principal amount back into your interest formula as many times as you specify.

You can also program your @functions to handle errors. To build on the example above, you can specify that the daily interest rate must be positive. If someone enters a negative interest rate as an argument, the @function will return ERR. You can also specify that any argument must be a value or a label. If someone tries to enter the wrong type of argument in your

@function, the @function won't accept that argument.

Writing formulas in *3-2-1 Gosub* isn't exactly like writing formulas in *1-2-3*. A few special rules apply. Every range that you specify within your formulas must contain at least two cells, even if only one cell in that range contains data. Also, if a formula enters information in any cell, you have to initialize that cell by entering the same type of information–value or label–in that cell before you even use the @function. These rules can slow you down at first. Sometimes when you edit formulas, you must remember to readjust your range references and reinitialize your ranges.

As mentioned, the Developer Edition of *3-2-1 Gosub* compiles your formulas into add-in @functions. In general, these @functions run faster than the worksheet-based @functions you create with the Standard Edition. I tested two worksheets, each containing 10 daily interest @functions described above. I used the Standard Edition to create the @functions in one worksheet and the Developer Edition to create them in the other. The Standard Edition's @functions took 15 seconds to recalculate; the Developer Edition's @functions took 5 seconds.

@Tools

If you're a competent C programmer, you can easily create @functions with *@Tools*–once you overcome obstacles presented by the program's incomplete and sometimes inaccurate documentation.

@Tools' manual states that the program works with two popular C-language compilers: *Microsoft C Optimizing Compiler*, versions 4 and 5.0 ($450 each), and Borland International's *Turbo C Professional* ($250). In truth, *@Tools* works only with the *Microsoft C* compilers. I found this out the hard way–by trying to use the program with *Turbo C*. *@Tools*' program disk has a READ.ME file that corrects this mistake in the manual, but that file is easy to overlook.

Even if you find the READ.ME file, you're still not out of the woods. *@Tools* requires that you use *Microsoft C* version 4's alternate floating-point math library or version 5.0's calling interface. However, the *@Tools* manual doesn't clearly state this requirement. If you installed *Microsoft C* according to its default settings, you won't have this alternate library or calling interface and you'll have to reinstate *Microsoft C* to make *@Tools* work. According to the publisher, a marketing brochure now included with *@Tools* clears up some of this confusion; I didn't receive a copy of this brochure in time to include it in the review.

These problems, and any others you encounter, are aggravated by the program's lack of telephone support. The publisher asks that you transmit any questions about the program via fax and promises a response by phone or by fax within a few days. In other words, if you need help in a hurry, you're out of luck.

> WITH @TOOLS, YOU CAN CREATE @FUNCTIONS THAT LINK 1-2-3 TO ANY C-LANGUAGE PROGRAM.

But once you get past these obstacles, *@Tools* is as easy to use as any other C library. Your first step is to reference *@Tools*' INCLUDE file in the programming code for your @functions. Then use the program's batch files to compile that code automatically, link the resulting object file to *@Tools*' library file, and convert your linked file into a *1-2-3* add-in, which you can then attach to *1-2-3*.

Writing a *1-2-3* @function in *@Tools* seems like a natural extension of programming in C. Numeric values used in *1-2-3*–be they arguments entered in your @function or values returned by your @function–are defined as standard C types; strings are defined as standard C strings.

Beyond Calculations

@Tools has two advantages over *3-2-1 Gosub*. First, it lets you manipulate certain *1-2-3* settings in the background. For example, you can create an @function that automatically adjusts the width of a column to fit whatever result the @function returns.

Second, because *@Tools* lets you create @functions that link *1-2-3* to any C-language program, your @functions can directly address any application written in C or any hardware device whose driver is written in C. You can create an @function that queries a database program, such as Borland's *Paradox*, or an SQL database program, such as *Oracle*. Or you can create an @function that takes data from an information-collection device, such as an optical character-recognition (OCR) scanner, and inserts that data into your worksheet.

These are only a few examples of what is possible. Unfortunately, the manual doesn't thoroughly document *@Tools*' full functionality. For example, the manual suggests that you can use *@Tools* to reallocate to other programs the memory normally used by *1-2-3*. An adventurous programmer might use this capability, say, to create an @function that automatically passes data to an active terminate-and-stay-resident program, such as *Sidekick*. But changing *1-2-3*'s memory allocation can have serious consequences–for example, it can hang up your system or corrupt your worksheet file. *@Tools*' manual neither mentions these consequences nor helps you avoid them. ■

Bill Lawrence is a network engineer based in southern California and author of *Using Novell NetWare* (Que Corp., Carmel, Ind.).

IN BRIEF

3-2-1 GOSUB. Frontline Systems Inc. 140 University Ave., Suite 100, Palo Alto, CA 94301, 800-451-0303, ext. 55. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires *1-2-3* Release 2/2.01 (with the Add-In Manager) or 2.2, and 3K of RAM in addition to that required by *1-2-3*. Standard Edition released 5/89, $99.95, Developer Edition released 10/89, $249.95, upgrade from Standard Edition to Developer Edition, $150. 90-day warranty against defective disks.

@TOOLS. PC Publishing, 1801 Avenue of the Stars, Suite 815, Los Angeles, CA 90067, 800-634-4554 or 213-556-3630. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires Microsoft C Optimizing Compiler, version 4 or 5. @Functions created with *@Tools* require *1-2-3* Release 2/2.01 (with the Add-In Manager) or 2.2. Released 1/88. $299.95. Unlimited warranty against defective disks.

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THE 386SX BLIZZARD

How to distinguish among the more than 100 machines available

BY GARRY RAY

What can you learn from reviews in a dozen computer magazines of the more than one hundred 386SX systems? Not much. It's simply impossible to get a grasp of the innumerable statistics and tests—or of the wide price variations—that have inundated the 386SX market. Try to digest it all, and you'll waste a week. Put another way, if you place a dollar figure on the time of your investigation, don't expect to save much when you finally choose your PC.

REVIEW
of
REVIEWS

When Intel Corp. announced the 386SX microprocessor two years ago, it said the chip was an economical, entry-level alternative to its older sibling, the 32-bit bus-design 386DX. Cynical computer-industry watchers claimed that the 386SX was Intel's gambit to reclaim the market share it lost through "second source" licensing. These licenses allowed authorized manufacturers, such as Advanced Micro Devices (Sunnyvale, Calif.) and Siemens A.G. (Santa Clara, Calif.), to duplicate, improve, and sell Intel's patented products, such as the ubiquitous 8088 or 80286 microprocessors. Often, these substitute processors came with prices and performance levels far better than Intel's.

With the introduction of the 80386 in early 1986, Intel became the sole authorized source for '386 microprocessors of all kinds and speeds. And as a replacement for its increasingly unprofitable and outdated '286 chip, the company developed and announced the 386SX, the lower-priced version of its new generation of chips.

The 386SX costs manufacturers about a third as much as the 386DX, which costs $190, and requires fewer and less-expensive system components to control its 16-bit bus. That, in addition to its complete compatibility with the more-powerful 386DX, have made 386SX systems the "hottest growth segment in the PC marketplace," according to Bruce Stephen, senior analyst at International Data Corp. in Framingham, Mass.

Customers quickly started buying 386SX-based systems that were priced just a little higher than '286 models. And prices for 386SX systems have been dropping steadily. They have reached a price range—$2,000 to $3,000—that, says Stephen, "tends to drive volume up." His estimates indicate that domestic shipments of 386SX systems will increase from 66,000 in 1988 to a projected 1.8 million in 1990. That's almost in accordance with Intel spokesman Howard High, who says that Intel is now shipping more SX than DX processors. High projects that 1.9 million 32-bit 386DX-based systems will be sold in the United States in 1990.

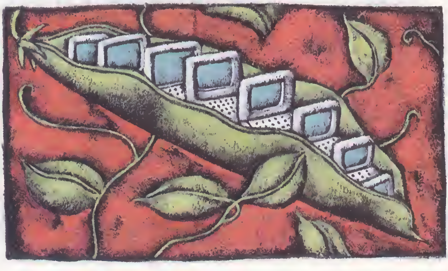
Interest in these systems has captured editorial attention, as well. Between August 1989 and April 1990, computer publications such as *PC Magazine, InfoWorld, PC Week, PC World,* and *Personal Computing* began to focus closer scrutiny on 386SX systems, following the increased interest of computer buyers.

PC Magazine, as usual, led the way. With one comparative review of fourteen 386SX systems in its August 1989 issue, followed by ratings of 31 systems in the Jan. 30 issue, *PC Magazine* outstripped all other publications in the quantity of its coverage of 386SX-based PCs. It also covered 11 portable 386SX computers in the March 13 issue.

Be aware that all prices noted in this article appeared in the original reviews as cited. Prices may vary from review to review due to configuration differences. Also, these prices almost definitely have changed since the time of publication.

In the January issue, *PC Magazine* applied its performance and features measurements to a lineup of 16 MHz, 386SX systems equipped with 40-megabyte hard disks, 1 megabyte of memory, and VGA displays. Its not-so-shocking conclusion: "No clear winners emerge in this roundup of 31 new 386SX machines."

But the magazine did manage to bestow three Editors' Choice Awards, four honorable mentions, and one uncatego-



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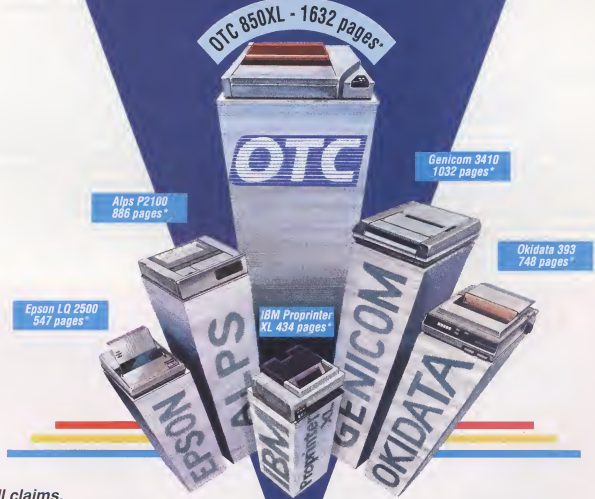

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rized recommendation. The Editors' Choice Awards went to: AST Research's Premium 386SX/16 ($4,385), Zeos International's 386SX-16 ($2,252), and Austin Computer Systems' Austin 386SX ($2,195). NEC Technologies' PowerMate SX Plus ($4,398), Epson America's Equity 386SX ($4,297), Softworks Development Corp.'s Citus 386sx TS ($2,930), and Gateway 2000's Gateway 386SX ($2,295), known as the Multiperformer, got honorable mention.

As hard as it is to believe, the much eschewed IBM PS/2 Model 55 SX ($4,668) was also recommended. Other publications took a much dimmer view of the machine: *PC World* cited the Model 55's "poor performance," *InfoWorld* called it a merely "satisfactory" value, and *Personal Computing* faulted it for its lackluster performance.

It's difficult to get a clear understanding of *PC Magazine's* awards criteria. The NEC PowerMate SX Plus is one of the most expensive SX machines reviewed. In fact, *PC Magazine* used a previous version—the PowerMate SX—as a benchmark of high prices in its August 1989 description of the equally priced Compaq Deskpro 386. Yet, in the January issue the NEC PowerMate SX Plus is cited for "long-term quality" and gets honorable mention, though it's unclear on what basis. This new version is in the same price and quality categories as 386SX entries from Data General, Wang Laboratories, and NCR Corp.—none of which get honorable mention.

PC Magazine also bestowed its Editors' Choice Award on the AST Premium 386SX/16. At $4,385 it is only $13 less expensive than the NEC system, which *PC Magazine* says "isn't cheap." The citation is apparently based on the architecture of AST's CUPID-32 system bus, which lets you upgrade to a 386DX or even an 80486 CPU by replacing the processor board. Given that all of the new AST machines use CUPID-32 (and have for more than a year), are we to expect these awards every time Intel releases a new processor and AST, like clockwork, designs a new upgrade board? One does wonder.

The guarded recommendation for the IBM PS/2 Model 55 is even more curious. Although *PC Magazine* said in its July 1989 First Looks column that "it would be difficult to take this machine seriously were it not for its IBM name," the magazine counsels readers in January to "keep [the Model 55] in mind."

The Austin 386SX, which won *PC Magazine's* Editors' Choice Award, also received decent reviews in *PC Week's* evaluation of five 386SX systems in the Oct. 30, 1989, issue. Other systems mentioned favorably were Advanced Digital Corp.'s (ADC) Powerlite 386SX, Eltech Research's Model 4682, MultiMicro's MMI-386SX16, and PC Craft's PCC 2200/16SX. All of these systems sell for less than $3,000, and most include VGA displays, 1 megabyte of memory, and at least 30 megabytes of hard-disk storage.

The Eltech and Austin systems were cited for their one-year offer of on-site, free service. Austin and PC Craft had the

MAKING A QUICK PICK

The task of picking the best 386SX computer appears to be extremely complicated. Counting portables, there are more than one hundred 386SX-based systems on the market—and more to come. But there are some general rules of thumb that will make your selection of a 386SX a far less challenging a task.

- Plan on spending about $2,500 to $3,000 for a 386SX system equipped with a 40-megabyte hard disk, 1 megabyte of 100-nanosecond memory, and a VGA display adapter and monitor. The system should also include at least one 3½- or 5¼-inch high-density disk drive.
- Avoid systems from companies such as Hewlett-Packard, Wang, Data General, and even IBM. These manufacturers tailor pricing for their largest corporate customers. Though generally of superb quality, styling, and design (not to mention impressive durability and performance), these systems can cost substantially more than a comparable system from a well known PC vendor.
- Consider your needs. Does the system have an 8- or a 16-bit VGA? If you're doing graphics, you'll want the latter. Does the system come with a sub-30-millisecond hard disk or disk-caching software? If you're a database maven, you will probably want all the speed you can get. Does it come with system diagnostics, ROM-based setup programs, and MS-DOS? Any system you purchase should include those in the base price.
- Consider mail order. Many of the well known mail-order companies cater only to the PC market and have done so since their inception. Some of these companies include the equivalent of "great products at great prices" at the top of their business plan. But be careful here and try to deal with companies that have won a national reputation for their products and customer support.
- Consider service and warranties. Even the humblest mail-order companies are now providing 30-day, money-back guarantees, on-site service, one year or more of parts-and-labor warranties, and other long-term service promises. You should also demand some or all of the above if you buy from a local retail store. Of course, a fly-by-night mail-order firm may not be around to deliver on its elaborate promises.
- If you buy from a local computer store, don't buy the line that a substantially higher price is offset by better service. Sometimes it is, often it's not. In any case, demand a written service policy and see how it compares to those of the larger mail-order companies.
- Finally, don't get too hooked on the most recent product review appearing in any of the popular trade magazines. Reviewers sometimes have a bad habit of gushing over the newest PC on the market—just read some of beyond-belief reports of the early 80486 systems. Stick with reputable companies, look for the cheapest price, and don't spend too much time lamenting your decision. If you've followed our guidelines, you've saved yourself lots of reading and teeth gnashing.

most expansion options, which *PC Week* considered more important than the minor price differences between all of the systems it reviewed. Intended applications were also considered: PC Craft offered the best graphics performance; the Eltech Research Model 4682 (since renamed the Model 2160), the best CPU performance; and the ADC, the best hard-disk performance.

The August 1989 issue of *Personal Computing* reviews seven SX machines, including Advanced Logic Research's FlexCache SX386Z ($1,795), Dell Computer Corp.'s Dell System 316SX ($2,199), Everex System's Step 386is ($2,799), Hewlett-Packard Co.'s Vectra QS/16 ($3,295), Tandy Corp.'s 4000SX ($2,599), and the IBM PS/2 Model 55 SX ($3,895). The Zeos International Ltd. 386SX-16 ($1,795) comes in for applause because of its low price, but the model reviewed is an older design that uses slower RAM chips and an older motherboard design. It is, in fact, the same version reviewed in the August 1989 issue of *PC Magazine*.

In its December 1989 issue, *PC World* reviews six 386SX systems, including AST Research's Premium Workstation/386SX ($4,545), Dell Computer Corp.'s Dell System 316 ($3,499), Hewlett-Packard Co.'s Vectra QS/16S ($5,929), IBM's PS/2 Model 55 SX ($4,610), Tandon Corp.'s PAC 386SX ($4,539), and Tandy Corp.'s 4000 SX ($4,646).

The AST and Dell systems are lauded for performance and price, respectively, while the impressive Hewlett-Packard system is chided for its near-$6,000 price tag. Tandon, which has often been noted for its speedy systems—*PC Computing* called its 80486 system "amazingly fast" in March—is in this review slighted for the sluggish gait of its 386SX entry. The Tandy 4000 SX is described as a moderate performer with a reasonable price and an impressive 16-megabyte memory capacity. The IBM PS/2 Model 55 SX, which has by now been thoroughly chastened in the press, is again noted for its generally underwhelming showing and limited potential.

The Bottom Line

Buyers should keep in mind that there are only two 386SX processors, and Intel makes them both. There are only a few memory architectures being employed in all these 386SX systems, and they provide roughly equal performance. There are only a few manufacturers selling 40-megabyte hard disks to 386SX vendors: Conner Peripherals, Seagate Technology, and Toshiba America Disk Products are at the top of the list. Popular VGA chip sets used by nearly all 386SX systems vendors are available primarily from Western Digital Imaging, Headland Technology (formerly Video Seven), and Tseng Laboratories.

Knowing that, and taking our quick-pick suggestions listed in the box on the previous page, will save time, money, and aggravation when you begin to consider your first 386SX system. Buyers are definitely in the driver's seat. ■

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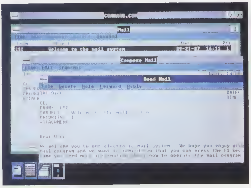
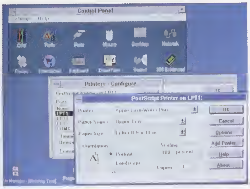


Windows 2.x was perceived to have a flat user interface and rigid installation rules,...



...while Windows 3.0 shows marked improvement in both configuration flexibility and in its use of graphical elements.

What does *Microsoft Windows* 3.0 have in common with such films as *The Ten Commandments, Gone with the Wind*, and *Apocalypse Now*? Like those epic films, *Windows* 3.0 is the result of a multiyear effort that was besieged by technical setbacks, runaway budgets, controversial hearsay, and abundant skepticism. In fact, *Windows* 3.0's sign-on marquee informs us that this product was five years in the making.

The result is a graphical computing environment that comes closer to the original vision of *Windows* than anything yet seen. Comparing the 1990 version of *Windows* with previous incarnations elicits the question: Were *Windows* 1.*x*, 2.*x*, /386, and /286 all prototypes of this most-recent effort? It would not be too unreasonable for Microsoft Corp. simply to forget the past and call the new product *Windows* II version 1.0. This version is, after all, the first version that seems to work satisfactorily.

A summary of *Windows* 3.0 improvements includes revamped installation procedures, direct support of the 80286 and 80386 operating modes, a totally new file manager, and a sleeker presentation of the *Windows* environment overall.

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The change in *Windows*' look is obvious from the moment you start up the program. Version 3.0 has a look and feel that is similar to the IBM-Microsoft Presentation Manager, and the appearance of the scroll bars, dialogue boxes, and other windowing features has noticeably changed for the better.

A new *Windows* program called the Program Manager is the focal point for organizing and executing programs that will run in the *Windows* environment. Both *Windows*-specific and MS-DOS applications can be integrated into the Program Manager. And like the Microsoft-IBM Presentation Manager, programs can be readily attached to an icon, a small drawing that represents the underlying application. It's easy to activate applications simply by using a mouse to click on the icon that represents the program. Adding programs to the *Windows* "desktop" and welding them to *Windows* icons is a simple process. *Windows* also offers a painless and automatic means of scanning a hard disk and adding known applications to the desktop pretty much on its own. *Windows* also lets you organize programs into groups, much like the "folders" of the Macintosh world.

Also new to *Windows* 3.0 is the Task List, which makes it easy to move from one application to another, to start or end a task, and to arrange the display of active applications on the *Windows* desktop. By striking the appropriate "hot key," you can invoke the Task List at any time, and you can do it from within any DOS or *Windows* application.

Setup and configuration of the *Windows* environment has also been improved. *Windows* users have long been accustomed to the bizarre practice of having to reinstall their system software to accommodate a change in hardware. Upgrading from EGA to VGA or purchasing a new mouse called for a complete reinstallation of the "easy-to-use" *Windows* environment. No more. *Windows* 3.0 includes a Setup facility–a *Windows* application, no less–that installs new or changed devices. Users merely feed it floppy disks that contain the requested device-driver files.

Similarly, the offbeat and confusing MS-DOS Executive–the built-in *Windows* file manager of the past–has been replaced with the simple, menu-driven File Manager, which is comprehensive and whose operation is intuitive. You can even use the File Manager as a program "launching pad" because files with specific extensions can be associated with the application programs that were used to create them. Clicking on the file invokes the program that was used to create the file. Because of its myriad features, the File Manager is an enormous improvement over the inept MS-DOS Executive. (For people who do like MS-DOS Executive, Microsoft still includes it as part of *Windows* 3.0.)

However, the most important improvement to *Windows* 3.0 is that it takes full advantage of the 80286 and 80386 microprocessors and fully supports their various memory architectures. Users are now completely insulated from the twiddling usually needed to exploit these features. *Windows* determines its optimal performance requirements automatically.

Users of 8086 machines that have less than 1 megabyte of memory won't be left in the lurch by *Windows* 3.0, but they will be severely limited by the speed and memory capacities of their systems. Such machines will be limited to operating in the *Windows* 3.0 real mode, which is similar to and compatible with *Windows* version 2.1.

For 80286 users, *Windows* 3.0 will operate in standard mode, allowing use of as much as 16 megabytes of extended memory. *Windows* 3.0 treats this memory as the execution space for multiple *Windows* and non-*Windows* applications. Switching from one application to another simply forces *Windows* to pay attention to a program located elsewhere in the memory pool. *Windows* applications designed for use with version 3.0 can access up to 16 megabytes of memory and can run simultaneously. Non-*Windows* applications can run in the foreground only (no multitasking) and must use the entire screen.

Finally, the *Windows* '386 enhanced mode allows both *Windows* and non-*Windows* applications to run simultaneously in either the foreground or the background and to run within individual windows. DOS applications can run on the multiple 8086 virtual machines made possible by the 80386 microprocessor, while applications written specifically for use with *Windows* 3.0 can use the virtual-memory facilities of the 80386 protected mode to swap data to disk just as though the disk space were working memory. Such applications can access as much virtual memory as free disk space and physical memory allow. It should be noted, however, that beta versions of *Windows* 3.0 exhibited many problems in handling 80386 virtual memory. Applications designed to run under *Windows* 2.*x* won't run in standard or '386 enhanced mode unless they have been upgraded for *Windows* 3.0.

Despite these difficulties, *Windows* 3.0 is probably the first version of the environment that bears serious long-term consideration. Its more-useful interface, more-intelligent implementation of utility programs, and long-overdue recognition of the 80286 and 80386 processors mean only one thing: Microsoft has once more heard and responded to its customers' concerns, which is the highest form of good customer relations. *—Garry Ray*

Microsoft Windows Version 3.0. Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052-6399; 206-882-8080. Requires MS-DOS 3.1 or higher and a hard disk with 6 to 8 megabytes of available memory. Enhanced mode requires at least 2 megabytes of memory; standard mode, at least 1 megabyte; and real mode, 640K. A mouse is recommended. Registered and run-time users can upgrade for $50. For upgrade information, call 800-323-3577. Released 5/90. $149.

CIRCLE 1 ON READER SERVICE CARD

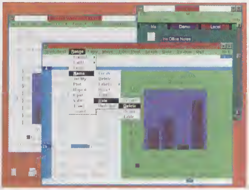
IRIS 3-FOR-3: Transform 1-2-3 Release 3 into a *Windows* 3.0 Application

With three PC operating environments and three–soon four–major versions of *1-2-3* available for PCs, things are becoming just a tad confusing. The *1-2-3* lineup of products for the PC includes *1-2-3/G* for OS/2's Presentation Manager, *1-2-3* Release 3 and Release 2.2 for MS-DOS, and the upcoming version of *1-2-3* for *Microsoft Windows*, due in 1991.

For those who do not want to wait for *1-2-3* for *Microsoft Windows*, yet want to run Release 3 under *Windows* and take advantage of many of the features of Microsoft Corp.'s graphical environment, Iris Associates, of Westford, Mass., may have a remedy.

It's called *3-for-3*, and its basic purpose is to convert *1-2-3* Release 3 from an MS-DOS program to a *Windows*-specific application that runs under *Microsoft Windows* version 3.0.

3-for-3's advantages are many. First, *Windows* 3.0 may become the preferred OS/2 alternative for the vast majority of PC users. Its graphical user interface, support for multitasking, and compatibility with most MS-DOS programs may be just the features that PC users have long awaited. Of course, *1-2-3* Releases 3 and 2.2 will run quite well under *Windows* 3.0, albeit without using any *Windows* capabilities. But running under *Windows* and being a "*Windows* app" are two different things.



3-for-3 makes *1-2-3* Release 3 a *Windows* 3.0 application, with pull-down menus, resizable windows, and other *Windows* features.

Virtually any program will run under *Windows* 3.0, but only those written specifically for the environment can use the extra bells and whistles that make *Windows* worth installing. Being a *Win-*

dows application implies the ability to reside and execute in resizable windows, the ability to exchange information with other *Windows* applications through the *Windows* clipboard or dynamic data exchange (DDE), and in general, the ability to take advantage of all the features offered by the *Windows* environment.

That's where *3-for-3* comes in. It modifies the OS/2 version of *1-2-3* Release 3 so that it becomes compatible with *Windows* 3.0. Why the OS/2 version of Release 3? Because an OS/2 program and a *Windows* program are substantially similar–enough so, at any rate, to allow *3-for-3* to tear out the OS/2 portions of Release 3 and replace them with *Windows* components.

The result is quite admirable: a *Windows* version of Release 3 that's as fast as the DOS and OS/2 versions, that can transfer charts and data into *Windows* applications, and that gains access to *Windows*' printer drivers. But *Windows* and *3-for-3* introduce an additional feature heretofore unavailable in Release 3: virtual memory.

On 80286 systems equipped with *Windows* 3.0, users won't notice an appreciable difference in the amount of memory available to run a Release 3 application. It will be slightly less than the total physical memory installed in the system, with a maximum of about 16 megabytes.

Run the *Windows* 3.0 and *3-for-3* combination on an 80386 system, and you'll see something altogether different. Release 3 will indicate that it has 15, 20, or even 30 megabytes of memory available. That's because *Windows* 3.0 and the 80386 system are together able to provide many megabytes of disk space, which the application regards as real, working memory. When data begins to overflow the random access memory, *Windows* 3.0 and the 80386 system divert the overflow to disk, keeping track of every bit for future use. When that diverted data is needed, *Windows* and the 80386 computer move it back into RAM. As you might imagine, execution slows down slightly during this process, but it may be a useful tool for some people.

Regarding the *Windows* 3.0 clipboard, *3-for-3* is not as flexible at exchanging data as are other *Windows* applications. The clipboard makes it possible to exchange data between Release 3 and other *Windows* applications. You can transfer *1-2-3* data to other applications by using *Windows'* DDE facility. For example, by creating a DDE link to an active *3-for-3* worksheet, you can automatically include and update spreadsheet cells, ranges, and graphs in *Microsoft's Word for Windows*. Any *Windows* application that supports DDE should be compatible with *3-for-3*.

Pull-down menus make almost any application more navigable, and *1-2-3* is no exception. *3-for-3* relocates all commands into menus that duplicate *1-2-3*'s menu structure. Printer and system commands are available from the *Windows* system menu, which is always located at the upper-left portion of the active application window.

3-for-3 transforms *1-2-3* into a sterling *Windows* application. But the announcement of *1-2-3* Release 3.1 will make any decision to buy *3-for-3* a bit tougher. With its pull-down menus, graphical interface, and spreadsheet-publishing features, Release 3.1 will be the choice for those who spend all day using little more than *1-2-3*.

But for anyone who has been or wants to be a *Windows* maven and who can't wait idly for Lotus's own version, *3-for-3* is the only deal in town. *—Garry Ray*

Iris 3-for-3 Version 1.0. Iris Associates, 239 Littleton Rd., Suite 8D, Westford, MA 01886; 800-225-5800, in Mass 508-692-2800 Requires an 80286, 80386, or 80486 computer with at least 1 megabyte of extended and 640K of conventional memory. Also requires *Microsoft Windows* 3.0 and *1-2-3* Release 3. Released 5/90. $99

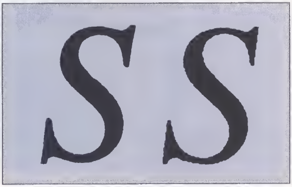
CIRCLE 2 ON READER SERVICE CARD

NEW LASER PRINTERS: More for Less

Bargain PostScript from IBM

PostScript, Adobe System's page-description language, has gained a wide following because of its variety of scalable fonts that can be printed in almost any size. But until recently the price of PostScript-based laser printers hovered around $4,500, a price most businesses couldn't justify paying for anything but strategic applications.

Now the prices are coming down, and surprisingly, IBM is leading the way. You can convert IBM's new LaserPrinter E into one of the least-expensive PostScript printers available. Start with the printer itself: Its base price of $1,495 and its five-page-per-minute output compare with so-called personal laser printers, such as the Hewlett-Packard HP LaserJet IIP and the Canon LBP-4. Next, add a megabyte of memory ($499) to the printer's standard 512K. Then choose among several PostScript options: a 1-font cartridge ($142); an 8-font cartridge ($245 each); a 17-font PostScript chip set ($449); or a complete, 39-font PostScript chip set ($899).



A close-up of a character printed with the LaserJet III's Resolution Enhancement (left) and in standard 300 dpi resolution (right). The LaserJet III adjusts the size and position of each dot to create smoother characters.

That means you can have full PostScript for $2,893, a good sampling of PostScript for $2,443, or just the PostScript fonts you need for even less. If the LaserPrinter E's five pages per minute isn't fast enough, buy the ten-page-per-minute IBM LaserPrinter ($2,395) and add the same options listed above. Or you can add a ten-page-per-minute hardware upgrade to the LaserPrinter E for $1,099.

Microsoft Word version 5.0, *WordPerfect* 5.1, and most other leading word processors have PostScript drivers. So do *1-2-3* Release 3 and *1-2-3/G*. However, to print your *1-2-3* Release 2.*x* or *Symphony* Release 2.2 worksheets on a PostScript printer, you need the PostScript drivers in *Allways* or *Impress*.

IBM LaserPrinter E. For information, contact National Distribution Division, 101 Paragon Dr., Dayton, NJ 07645; 800-IBM-2468. Size: 10.2 inches high, 14.2 inches wide, 20.5 inches deep. Weight: 33.6 lbs. $1,495. 512K of RAM standard. 1-megabyte add-on memory card, $499; 2-megabyte card, $899, 3.5-megabyte card, $1,599. Combination toner-drum cartridge good for 10,000 pages, $199.

CIRCLE 3 ON READER SERVICE CARD

HP LaserJet III: Improved Output Quality

All product upgrades should be like the HP LaserJet III. The LaserJet III costs $2,395, $300 less than its predecessor, the LaserJet Series II. But it comes with significant extras: 300-dot-per-inch output that looks more like 600 dpi, and eight internal scalable typefaces (HP's own, not PostScript). And unlike any previous LaserJet, the LaserJet III comes with enough memory to print full-page graphics: 1 megabyte of RAM is standard.

The secret behind the clear, sharp print of the LaserJet III is Resolution Enhancement Technology. The printer adjusts the size and position of each printed dot to create smoother edges and straighter lines (see figure). You can really see the difference when printing small italic fonts or lines that are nearly but not quite vertical or horizontal.

The LaserJet III's scalable fonts can be printed in quarter-point increments from 1 point to 999.75 points. The eight fonts included with the printer are normal, bold, italic, and bold-italic versions of CG Times and Univers (a Helvetica look-alike font). Hewlett-Packard also offers two scalable-font cartridges for $399 each; one cartridge contains 25 additional fonts, the other contains 26 additional fonts. To maintain compatibility with previous LaserJets, Hewlett-Packard has included built-in, bit-mapped Courier (both 10-point/12-pitch and 12-point/10-pitch) and Line Printer (16-point/66-pitch) fonts with the LaserJet III.

By mid-1990, most leading word processors should have drivers for the LaserJet III and should be able to take advantage of the printer's scalable fonts. *1-2-3* Release 2.2 will support specific type sizes of some of the LaserJet III's scalable fonts, via *Allways*.

PRINTING SPEED: LaserJet III vs. OkiLaser 820
(Documents created with *WordPerfect* 5.1, unless otherwise noted)

	LaserJet III	OkiLaser 820
2 pages, containing 9 fonts in different sizes		
First page:	:37	:17
Both pages:	:42	:36
8 pages, 10 & 12-point Times-Roman with various attributes		
First page	:44	:25
Eight pages	1:53	1:40
1 page, containing 3 fonts, 1 graph	1:07	1:05
1/2-page graph, printed with PrintGraph	2:25	2:23

Your graphs should print faster, too. The LaserJet III supports the Hewlett-Packard Graphics Language/2 (HP-GL/2), which enables some programs, such as *Lotus Freelance Plus*, to send less data to the printer when printing graphics. Other programs use HP-GL/2 to rotate graphics or the LaserJet III's scalable fonts by 90 degrees.

Since PostScript's greatest benefit is its scalable fonts, the LaserJet III all but eliminates the need for PostScript. But PostScript offers other benefits. For example, it lets you rotate text and graphics by any degree, and it creates files that you can use with most professional typesetting equipment. If you need these benefits, the LaserJet III lets you have PostScript—but at considerable extra cost. Hewlett-Packard offers a $695 PostScript cartridge that plugs into one of the LaserJet III's slots and provides 39 PostScript fonts. To use the cartridge, you need to add another megabyte of memory to the printer, at a cost of $495. That drives the total price of PostScript to $3,585. If that's too much, the PostScript cartridge also works with the slower but less expensive HP IIP.

Hewlett-Packard HP LaserJet III. Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900. Size: 8.5 inches high, 18 inches wide, 19 inches deep; with paper tray, 24.5 inches deep. Weight: 50 lbs. 1 megabyte of RAM standard. $2,395. 1-megabyte add-on memory board, $495, 2-megabyte board, $990. Toner cartridge good for 4,000 pages, $125.

CIRCLE 4 ON READER SERVICE CARD

OkiLaser 820: Competing With Speed?

According to Okidata, its OkiLaser 820 ($2,295) uses special chips to scale fonts three to ten times faster than the LaserJet III. The result is that when you print short documents with lots of different fonts, the 820 may be the fastest laser printer in its price range.

The 820 is especially fleet when printing your first page. In our tests, it printed a single page with two different fonts and several print attributes in 25 seconds; the LaserJet III printed the same page in 44 seconds. But when printing several pages, the time savings are less dramatic. For example, the 820 printed the next seven pages of the test document in 1 minute and 15 seconds; the LaserJet III printed the document in 1 minute and 9 seconds. When printing bit-mapped fonts or graphics, the 820 is about as fast as the LaserJet III.

Unlike the LaserJet III, the OkiLaser doesn't offer enhanced resolution, and Okidata has not yet created drivers to let you use the 820's scalable fonts with *1-2-3* or *Symphony*'s *Allways* add-in. But because the 820 is compatible with the LaserJet II, it can print *Allways*'s built-in software fonts.

Out of the box, the OkiLaser gives you more fonts than the LaserJet III. It comes with 13 built-in scalable fonts from industry leader Bitstream, each of which can be printed in any size from 4 to 240 points. It also includes 26 bit-mapped fonts in fixed sizes, which you can use with software installed for the LaserJet II. And by mid-year, Okidata promises a library of font cards priced from $195 to $395.

The OkiLaser 820 doesn't have a PostScript option, but the OkiLaser 840 is a PostScript printer that is competitively priced ($3,595) and that offers LaserJet II compatibility.

—Peter Aitken and Mark Scapicchio

OkiLaser 820. Okidata, 532 Fellowship Rd., Mount Laurel, NJ 08054; 609-235-2600. Size: 8.5 inches high, 17.7 inches wide, 17.7 inches deep. Weight: 37 lbs. 512K of RAM standard. $2,295. 1-megabyte add-on memory board, $445; 2-megabyte board, $990. Toner cartridge good for 2,500 pages, $33; printing drum good for 11,000 to 15,000 pages, $289.

CIRCLE 5 ON READER SERVICE CARD

BUSINESS, FINANCE

1-2-3 Template Analyzes the Competition

Get the lowdown on the competition with *Competition Analyzer.* This template for *1-2-3* helps analyze the strengths and weaknesses of business competitors. It provides a consistent system for evaluating the competition in areas ranging from product benefits to company image. The program produces graphs of the companies to watch, ranking the firms according to their market position.

Requires *1-2-3* Release 2.01, 2.2, or 3. $109, from Successware, 203 Annandale Dr., Cary, NC 27511; 919-469-0119.

CIRCLE 6 ON READER SERVICE CARD

Low-Cost Accounting for Individuals or Networks

Accounting Pacioli 2000 emphasizes low cost and ease of use. You can use the integrated, eight-module accounting system as a stand-alone program or on a network. It supports service- and inventory-based businesses, cash and accrual accounting methods, unlimited receivable and payable control accounts, and five inventory-costing systems, including LIFO and FIFO. The interface includes pull-down menus, mouse support, and on-line help. Data can be exported in ASCII format to other applications, including *1-2-3* and *Symphony*.

Requires DOS 2.1 or higher (DOS 3.1 or higher for network use) and 640K of RAM. Mouse optional. $49.95, including a training video and ongoing technical support. From M-USA Business Systems, 17440 North Dallas Pkwy., Suite 207, Dallas, TX 75287; 214-931-0024.

CIRCLE 7 ON READER SERVICE CARD

Automate Retail Operations

Small retailers are the intended market for *RealWorld Point-of-Sale Plus*, a seven-module, integrated package for automating cash register, inventory, and accounting functions. Modules include point of sale, inventory, accounts receivable, accounts payable, payroll, check reconciliation, and general ledger. The program supports such peripherals as cash drawers, bar code readers and scanners, and invoice and receipt printers.

Requires DOS 3.3 or higher, 640K of RAM, a hard disk, and a 132-column printer. $495, including a self-running demonstration tutorial. From RealWorld Corp., 282 Loudon Rd., P.O. Box 2051, Concord, NH 03302-2051; 800-678-6336, in N.H. 603-224-2200.

CIRCLE 8 ON READER SERVICE CARD

PRINTER UTILITIES

HP DeskJet Control from 1-2-3 or Symphony

With *DeskSet*, a new add-in for *1-2-3* or *Symphony*, you can use menus instead of setup strings to control Hewlett-Packard's HP DeskJet and DeskJet Plus printers. The menus let you specify margins, headers and footers, line spacing, portrait or landscape mode, number of copies to print, and other settings. The program prints up to 15 ranges in a single pass. It supports soft fonts, cartridge fonts, and internal fonts and lets you assign different fonts to different ranges or cells.

Occupies 64K of RAM and requires *1-2-3* Release 2, 2.01, or 2.2 or any version of *Symphony*. $95 plus $5 shipping, from Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222.

CIRCLE 9 ON READER SERVICE CARD

Trio of LaserJet Utilities

Insight Development Corp. has three new utilities for users of Hewlett-Packard's LaserJet III. *Spool-Q* automatically spools print jobs to disk or to the printer, freeing the computer for other tasks. *InPlot* offers a menu for choosing pen widths and fill patterns and lets you use the printer's resident fonts to combine plotter output with text. *InScreen* performs screen captures and screen dumps. It works in both DOS and *Microsoft Windows* environments and can be used with nearly all HP printers.

Requires DOS 3.0 or higher and 256K of RAM. *Spool-Q*, $79; *InPlot*, $99; *InScreen*, $59; from Insight Development Corp., 2200 Powell St., Suite 500, Emeryville, CA 94608; 800-825-4115, in Calif. 415-652-4115.

CIRCLE 10 ON READER SERVICE CARD

OTHER UTILITIES

Six Handy @Functions

@Ease Set of Six is a subset of the original *@Ease* library of @functions for use with *1-2-3*. These functions perform the following tasks: center titles over a range of columns rather than over a specific column; sum values as they are displayed in a worksheet (without rounding); calculate subtotals and grand totals of ranges; repeat a character in a cell one less than the cell's width (to separate an underline from an adjacent column, for example); calculate and display a month name and the day of the week for a given date; and calculate the sum of the columns in a range.

Requires *1-2-3* Release 2 or higher. $59.95, from Spreadsheet Solutions Co., 600 Old Country Rd., Garden City, NY 11530; 800-634-8509, outside of the U.S. 516-222-1429.

CIRCLE 11 ON READER SERVICE CARD

Worksheet Utility Reduces Eyestrain

Big, a memory-resident utility for use with *1-2-3*, is designed to enlarge portions of the screen display. Intended for use by the visually impaired, the program operates automatically, in the bottom window of a split screen. The top window displays the worksheet normally. The portion enlarged is context-sensitive. For example, if the cursor is in a menu, the utility enlarges the menu choice you highlight and its description. If *1-2-3* displays an error message, the utility enlarges it. Documentation is provided both on disk and printed in 18-point type.

Works with any release of *1-2-3*, but with Release 3 you must use text-mode drivers and cannot use the Window Perspective command to view 3-D worksheets. $39, from Hexagon Products, P.O. Box 1295, Park Ridge, IL 60068-1295; 708-692-3355.

CIRCLE 12 ON READER SERVICE CARD

OTHER SOFTWARE

Teach Your PC a New Language

Translating English text into French is the forte of *Foreign Language Translator.* For speed and compactness, the dictionary contains only 75,000 words. However a series of algorithms expands the 75,000 root words into nearly

PAUL YALOWITZ

1.5 million word forms. For example, from the root word *high* in the dictionary, the algorithms can translate *highest, highly*, and *highness*. The program also conjugates French verbs, checks for correct French grammar, and can translate idiomatic phrases, such as "What's cooking?" (Qu'est-ce qu'il y a?). You can import *Microsoft Word, WordPerfect, PC-Write*, and ASCII documents or enter words directly. The company also plans to offer German and Japanese translators.

Requires DOS 3.0 or higher and 384K of RAM. $599 for the standard version; $2,995 for the professional version, which contains technical terms for commercial and industrial applications. Both versions include pull-down menus and context-sensitive help. From Softechnics, 30849 48th Court South, Auburn, WA 98001-2654; 206-735-5000.

CIRCLE 13 ON READER SERVICE CARD

WordPerfect Speaks in Tongues

WordPerfect Corp. has released Russian and Greek language modules for *WordPerfect* 5.1. Along with 17 other modules, they let you create and edit multilingual documents from within the English-language version of the word processor. The modules contain screen fonts, keyboard and printer drivers, and a hyphenation program. The Greek module has keyboard drivers for both classical and modern Greek. The Russian module provides Cyrillic characters in three different keyboard arrangements. By customizing the keyboard drivers, users can type in Belorussian, Bulgarian, Georgian, Macedonian, Old Church Slavonic, Serbian, or Ukrainian.

Each module occupies about 150K of RAM and requires an EGA, VGA, or Hercules graphics card with RamFont to display screen characters. $49 each, from WordPerfect Corp., 1555 North Technology Way, Orem, UT 84057; 801-222-4222.

CIRCLE 14 ON READER SERVICE CARD

BOOKS

Lotus 1-2-3 Tips and Tricks, 2nd Edition, by Gene Weisskopf. Provides side-by-side coverage of *1-2-3* Releases 2.01 and 2.2, with pointers for each version; expanded treatment of macros; expert applications with file-linking; and new techniques for graphics, including macros for automated slide shows. 441 pages, $22.95 (paperback). Published January 1990 by Sybex, 2021 Challenger Dr., Number 100, Alameda, CA 94501; 415-523-8233.

CIRCLE 15 ON READER SERVICE CARD

Current Information Technology Resource Requirements of the Federal Government, from the U.S. Office of Management and Budget. Analyzes the current federal requirements and planned acquisitions of information technology, as contained in the U.S. budget for fiscal year 1990. 693 pages, $60 (order number PB90-146820KOJ). 38-page summary, $15 (order number PB90-146812KOJ). Both volumes, $64 (order number PB90-149980KOJ). $3 handling charge per order. Published January 1990, by National Technical Information Service, an agency of the U.S. Department of Commerce, Springfield, VA 22161; 703-487-4650.

CIRCLE 16 ON READER SERVICE CARD

TRAINING

Disk-Based Tutorial on Freelance Plus

Teach Yourself Lotus Freelance Plus uses an interactive approach to explain Lotus's business-graphics package. The tutorial covers such topics as preparing charts, enhancing drawings, using the portfolio, and creating effective graphics presentations.

Requires DOS 2.0 or higher, 640K of RAM, an EGA or VGA monitor, and a hard disk with 2 megabytes of storage available. $99.95, from American Training International, 12638 Beatrice St., Los Angeles, CA 90066; 800-955-5284. Discount coupon good through December of 1990 is included in *Freelance Plus* packages.

CIRCLE 17 ON READER SERVICE CARD

Release 3 with a French Accent

In French or English, *Learning Lotus 1-2-3 Release 3—The Video Training Program* covers the basic features of the program, plus advanced subjects, such as 3-D capabilities, perspective views, cell mapping, and using multiple active worksheets. You get a 160-minute VHS or Beta videocassette, a guidebook, a reference manual, command charts, and a demonstration disk.

Requires *1-2-3* Release 3, plus a videocassette player and monitor. $360 (U.S.), from Creatronix Innovative Technology, P.O. Box 265, Station A, Longueuil, Quebec, Canada J4H 3X6; 514-647-5528.

CIRCLE 18 ON READER SERVICE CARD

Mix-and-Match Training

The Lotus 1-2-3 Learning Systems series consists of two new training programs: one for Release 2.2, another for Release 3. Both programs begin with the same introductory module; separate advanced modules deal with the products individually. Each module includes a videocassette, a data disk, and a manual. The publisher is offering a 20% discount to users of other MicroVideo products and to anyone who trades in a competitive product.

Courses require *1-2-3* Release 2.2 or 3 plus a videocassette player and monitor. $495 per module in VHS or Beta formats; $595 for 3/4-inch videotape (or $895 for the introductory module plus one advanced module in VHS/Beta; $1,095 for 3/4-inch tape). From MicroVideo Learning Systems, 91 Fifth Ave., Suite 600, New York, NY 10003; 800-231-4021, in New York 212-255-3108.

CIRCLE 19 ON READER SERVICE CARD

Information for New Products is supplied by the vendors and was up to date as of this writing. Since production specifications change frequently, we recommend that you verify this information with a dealer before making your purchase

NEW!

ForeCalc

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Every businessperson knows that accurate forecasts translate directly into better decision making and increased profits. That's why smart businesspeople everywhere are turning to **ForeCalc**.

ForeCalc allows you to create accurate forecasts quickly and easily without ever leaving your spreadsheet. **ForeCalc** requires no background in forecasting, is exceedingly simple to operate and costs under $150.

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CIRCLE 120 ON READER SERVICE CARD

ADD-ONS

99	89	eHelp	Your own context-sensitive F1 help screens.
149	134	eMacros	Serious developer macros.
129	116	e@funcs	40 developer @functions.
149	134	eTools	Pop-up menus and other developer tools.
89	79	easyDOSit	DOS shell for 1-2-3 users.
119	107	Impress	Quality print.
89	79	Look&Link	Recalculate through a set of linked files.
89	79	Seemore	See more rows and columns.
169	156	@Base	Create large databases not restricted by memory.
469	469	Baler	Create applications that run from DOS.
49	44	Sideways	Print sideways.

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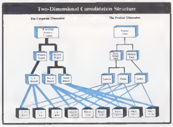

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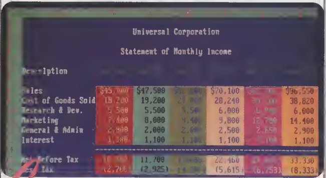

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Description						
Sales	$45,000	$47,500	[illegible]	$70,100	[illegible]	$96,550
Cost of Goods Sold	18,200	19,200	[illegible]	28,240	[illegible]	38,820
Research & Dev.	5,300	5,500	[illegible]	6,000	[illegible]	6,000
Marketing	7,400	8,000	[illegible]	9,800	12,700	14,400
General & Admin	2,800	2,000	[illegible]	2,500	2,650	2,900
Interest	1,100	1,100	[illegible]	1,100	[illegible]	1,100
Net Before Tax	[illegible]	11,700	[illegible]	22,460	[illegible]	33,330
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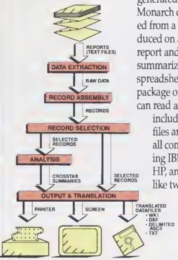

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ESSAY

What Price Printers?

BY LINDSY VAN GELDER

When I first needed a low-cost letter-quality printer, there was no such thing. Back in 1982 you could buy a loud, slow, 9-pin dot-matrix printer whose output was about as elegant as the computer coding on a bank check, or you could buy an even louder, slower, bankbook-breaking daisy-wheel printer.

As a free-lance writer, my livelihood depends on keeping editors happy, so I ran some samples of the dot-matrix stuff past a few of the people I write for. Every last one of them despised it. "Painfully unchic," declared one *Vogue* editor. I bought the daisy-wheel.

When the daisy-wheel finally went to that Great Hardware Heap in the Sky a few months ago, I found myself bewildered by the printer technologies now available to the home-office or small-business computer user. If money is no object, your choice is simple: a laser printer with the maximum bells, whistles, and memory. But for those of us on a tight budget, there are three possibilities: a 24-pin near-letter-quality (NLQ) dot-matrix printer, a "personal" laser printer, and an ink-jet pseudolaser.

The good news is about prices: You can buy one of each for a total of only slightly more than what my daisy-wheel set me back eight years ago. The bad news is that each type has at least one serious flaw, and you'll have to pick which problems you'd rather live with.

The 24-pin NLQs, like all impact printers, have the acoustic subtlety of a garbage truck grinding up old coat hangers. But since I can't write more than about 20 minutes worth of printer clatter a day, the noise was a minor drawback. And the output of the models I looked at from Epson, Panasonic, and other manufacturers was eminently readable.

What nixed the 24-pin solution for me was, oddly, the economics. In *theory* the 24-pins are the cheapest NLQ deal in town—as low as $400 at street prices if you don't care about a wide carriage, dual parallel and serial interfaces, a sheet bin, or blazing speed. But if you do care, and I did, you're quickly in the range of the ink-jet printers, such as Hewlett-Packard's DeskJet Plus (a little over $650), which have discernibly nicer print.

Indeed, I found the DeskJet's print virtually indistinguishable from that of a laser, except in very small type sizes. It's also very well designed: It weighs less than 15 pounds, you can push it flat against the wall, it's whisper-quiet and twice as fast as comparable 24-pins, and it has dual ports and a built-in sheet feeder.

But of course there's a rub—several, actually. Ink cartridges cost $18.95 apiece and yield about 400 pages, which works out to about a nickel a page. Compare that with the cost per page of a $10 dot-matrix printer ribbon. However, given my page-per-day output, I figured I could live with that one. Nor was I bothered by the DeskJet's inability to deal with odd-size paper. But the last flaw was fatal: The ink it uses isn't waterproof. A drop of rain on an envelope? Worse (shudder), *an editor spilling coffee on my copy*? I moved on to the newer Hewlett-Packard LaserJet IIP, a "personal" laser printer street-priced at just under $1,000.

Like a 24-pin dot-matrix, the baby laser needs some extras to do anything complicated. For example, if you want full-page graphics, you must buy extra memory. Since I had no plans to do anything complicated, no problem. The IIP is a little clunkier than the DeskJet Plus, but its price per page is less, its speed is about double, and its protocols are an established industry standard. Best of all, you can dunk its output into any of the Great Lakes, should you be so inclined. It seemed well worth an extra few hundred dollars.

Then, as I was practically on my way to the computer store, I noticed a casual reference on CompuServe to the IIP's "large power consumption."

Now, I live and work in a prewar New York City rental apartment that has a special button on the dining room floor for summoning the maid but has no help at all for those of us who rely on electrical appliances instead of servants. We have a sign on the kitchen wall reminding us never to use the toaster oven and the dishwasher at the same time. In my office, the computing equipment already competes with the air conditioner, the copier, a short-wave radio, and several halogen lights.

I called Hewlett-Packard for the specs. Sure enough, the IIP uses 90 watts merely to idle. It needs 550 (count 'em) watts to get down to work. The HP rep made apologetic noises about parts that need to heat up, this being, after all, a laser printer.

The DeskJet Plus needs only 25 watts to print. I bought it.

So far I've been very happy with it. But the first time an editor calls me to complain that he was reading my article in the tub, and....

Lindsy Van Gelder is a free-lance writer based in New York City.

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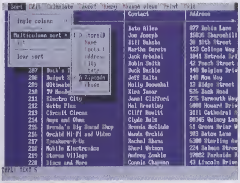

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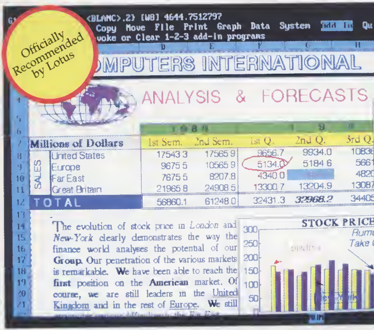

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	Europe	9675 5	10565 9	5134.0	5184 6	5661
	Far East	7675 5	8207.8	4340 0		4820
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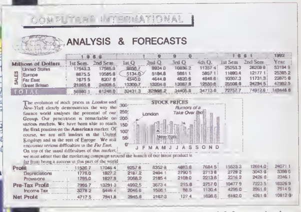

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